A User-Centric Tool for Generating Academic Profiles using a Pre-Trained Large Language Model

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Abstract

This project aims to design a tool for creating academic profiles tailored to BDEs and their external partners by integrating information from multiple sources. Adopting a UCD approach, the project emphasized user-centric considerations in its design stages: pre-design, formative evaluation, and summative evaluation. Key challenges identified with current tools included insufficient and outdated information, inconsistencies in profiles, and information maintenance and dissemination issues. Semi-structured interviews revealed different BDE opinions on what a profile should contain, which called for a design that incorporates automation with the ability to customisation based on BDEs needs. The formative evaluation indicated diverse user preferences in profile creation, with some users preferring to start with a standard profile, then removing the non-relevant information while others preferred to build the profile from step by step from scratch. The tool incorporates a Large Language Model (LLM) to generate the biogrpahy automatically using OpenAI's GPT-3.5. The tool along with the profile and biogrpahy generated were assessed by various BDEs during Think-Aloud sessions in addition to filling a SUS questionnaire. Results from the Think-Aloud sessions and the SUS questinnaire show promising results in adopting the tool as part of the BDEs workflow. Results indicated satisfactory accuracy levels and relevance, with BDEs appreciating standard information, while external partners being more interested in the relevant work.

Research Ethics Approval

This project obtained approval from the Informatics Research Ethics committee.
Ethics application number: 7569
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Before the start of each user study session, the participant information sheet (Appendix A) and consent form (Appendix B) are sent to the participants to explain the nature of the study and allow participants to make an informed decision about participating. At the beginning of each session, participants are reminded of how long the session will take, that it will be video-recorded, and their right to withdraw from the interview at any time should they want to. During the sessions, no personal or sensitive questions were shared, and interviewees were encouraged to express their views without being led to specific directions.

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Chapter 1

Introduction

1.1 Motivation

As a commercialisation service, Edinburgh Innovations hires Business Development Executives (BDEs) to help businesses transform their innovative ideas into real-world applications [37, 38]. Internal and external partners reach out to the BDEs and in return, BDEs nominate the most suitable academics for collaboration. Though the process is critical in securing collaboration opportunities, there is no standard method for BDEs to compile information about academics into a single profile and share it with external partners.

Currently, information about academics is spread across the web, on researcher profiles, institutional pages, personal web pages, and social media accounts [26, 29]. Researcher profiles provide an overall view of the academic's contributions and achievements but they tend to be lengthy and research-focused which may not be relevant to non-academics. In institutional pages, the online identity of the academic is built within the limits of the university [36] and when academics are given liberty on how they represent themselves on these pages, it can lead to inconsistencies in presentation and content. Personal web pages and social media accounts allow academics to present their work to the world in a way that is strategic and they are often used as 'calling card'[15]. Though each profile serve a purpose for the academic, having multiple profiles requires commitment to maintain these profiles [12]. Given academics have various responsibilities, asking them to curate a profile according to a 'potential customer' is not a realistic request. Additionally, sending multiple versions of academic profiles to a client is inefficient and ineffective for both the BDE and the client. Finally, sending profiles that lack the appropriate structure and relevance to attract the client may deter potential

clients. To address the existing gap, this project aims to create a tool that allows BDEs to customise academic profiles and share them with ease and confidence.

1.2 Aims and Objectives

This project aims to improve the quality and consistency of academic profiles to meet the needs of BDEs and their clients by creating a tool that pulls information from multiple sources and constructs an academic profile with a biography generated using a Large Language Model (LLM). The project seeks to achieve the following objectives:

- Discover the challenges the BDEs encounter when evaluating academics and sharing their profiles for potential collaboration.
- Identify the key information that the academic profile should include, according to what the BDEs think is appropriate for their clients.
- Design a tool to automate the generation of academic profiles by integrating information from multiple sources.
- Investigate the impact of integrating a language model into the tool to generate the academic's biography.
- Evaluate the tool regarding its usefulness in generating academic profiles that are accurate and relevant. [5]

1.3 Research Questions and Approach

The research is guided by the following questions:

- RQ1: What comprises a compelling academic profile according to the BDEs?
  - RQ1.1: What challenges do the BDEs face in identifying and evaluating academics and sharing their information with their customers?
  - RQ1.2: What are the solutions to facilitate the presentation of academic profiles that tailor to the needs of the BDEs and their clients?
- RQ2: How can a tool be designed to generate profiles tailored to the BDEs needs?
  - RQ2.1: What are the tools' requirements to effectively generate profiles?

  - RQ2.2: How to best personalise the profile generation process to meet various users' needs and preferences?

- RQ3: To what extent can the new tool generate profiles that tailor to the needs of the BDEs?

  - RQ3.1: How useful is the tool for the BDEs?
  - RQ3.2: How accurate and relevant are the profiles generated by the tool?
  - RQ3.3: How do BDEs perceive the quality of the generated biographies?

A User-Centred Design (UCD) approach [51, 31] was employed to answer these research questions. UCD is a design philosophy and a process in which the needs, preferences, and challenges of the users are placed at the centre of every stage of the design process [31]. With the UCD approach in mind, the methodology framework consisted of three stages as follows:

- Pre-design: This stage aims to answer RQ1 with its sub-questions RQ1.1 and RQ1.2 and to contribute to answering RQ2.1. The stage is described in chapter 3 and it consists of two parts. First, An initial interview with the BDE who started the project, to understand the context of use and to understand some of the challenges with the existing tools. Second, semi-structured interviews to identify more challenges, extract the needs of BDEs to address those challenges and elicit the initial set of user requirements. Findings of this stage include identifying the initial set of requirements which affects the design of the low-fidelity prototype.

- Low-fidelity prototype and formative evaluation: This stage aims to address RQ2 with its sub-questions RQ2.1 and RQ2.2. The stage is presented in chapter 4 and it consists of 2 parts. First, designing a low-fidelity prototype using Balsamiq to inform the final design of the tool's User Interface (UI). Second, evaluating the prototype using Think-Aloud Protocol to validate the deign choices, identify usability problems, verify the identified user requirements from the previous stage and to elicit more requirements from users. Findings from this section include verifying the UI design and functionality required for the tool as well as identifying usability problems associated with the design, which both contribute to the design of the high-fidelity prototype.

- High-fidelity prototype and summative evaluation: The aim of this stage is to address RQ3 and its sub-questions RQ3.1-RQ3.3. This stage is described in

chapter 5 and it consists of 3 parts. First, an overview of the design of the final prototype and implementation considerations. Second, evaluating the usefulness of the tool and its effectiveness in generating profiles according to the needs of the BDEs and external partners. Third, evaluating the accuracy and relevancy of the generated profiles and biographies as well as the quality of the generated biography. Findings of this stage draws conclusions on the potential of the tool in facilitating the BDEs' process of finding academics and producing profiles that can be shared with external partners, with ease and confidence.

1.4 Structure of the dissertation

The remaining of this document is structured into 6 chapters. Chapter 2 presents the literature review which focuses on understanding the latest practices of profile and biography generation, the use and evaluation of Large Language Models (LLMs), and the approaches to working with users on projects. Chapter 3 describes the pre-design stage and addresses RQ1.1, RQ1.2, and RQ2.1. Chapter 4 describes the formative evaluation stage, adds to RQ2.1, and answers RQ2.2. Chapter 5 describes the summative evaluation stage, presents design and implementation decisions, and answers RQ3.1, RQ3.2, RQ3.3, and RQ3.4. Chapter 6 provides summary of the answers to the research questions, discusses the limitations of the research, and provides recommendation for future work.

Chapter 2

Literature review

This chapter reviews literature relevant to the key themes of the research with section 2.1 exploring academic profiles and biography generation, section 2.2 presenting a summary of text generation and LLMs and section 2.3 providing an overview of the research methodology which is focused around user involvement in the development process.

2.1 Academic Profiles and Biography Generation

The digital representation of academics and their work in the age of social media and online networking allows for enhanced visibility and outreach [15, 36]. Online profiling platforms provide a range of services for researchers and authors, primarily for sharing research and networking [29]. Key platforms include bibliographic databases platforms like Scopus [18], Web of Science [17], PubMed [24], and Google Scholar [61], and scholarly networking sites such as ResearchGate [2] and Academia.edu [1]. More recent platforms include the Open Researcher and Contributor Identification (ORCID) [53] project which aims to solve the issue of author name confusion, and Publons [16] which awards editorial reviewer achievements by making their comments public. [29] Maintaining academic profiles can be time-consuming with some requiring relatively low-maintenance while others demanding more interaction from the academic [12]. Recognising this challenge, researchers have explored methods to generate profiles and biographies automatically. For instance, Holanda and colleagues [33] investigated the problem of compiling user profiles from different data sources. They employed an agent-based approach, pulling data from multiple sources such as LinkedIn [44] and Google Scholar [30]. Chamoso and collaborators [14] proposed a system to

visualise word associations in profiles where users can enter basic details which the system uses to gather more online data and process it for text and image analysis. Ambavi et. al. [6] combined Machine Learning and Natural Language Processing (NLP) techniques to extract and classify and cluster life events in biographies. More recently, Ranjan et. al. [55] explored a Recurrent Neural Network (RNN) to curate a biographical summary from multiple sources. However, RNNs suffer from the vanishing and exploding gradient problems which affects the RNNs ability to learn long-range dependencies in large input text [66]. This project investigates incorporating an LLM with a Transformer architecture to understand the context of the retrieved profiles, summarise it and generate a more concise overview of the academic. The Transformer architecture is a deep learning model that uses self-attention mechanisms to process input data in parallel rather than sequentially, enabling state-of-the-art results in various NLP tasks [66]. To date, using LLMs for biography generation remains unexplored, opening an opportunity to creating academic profiles with auto-generated biographies.

2.2 Text Generation and LLMs

The landscape for text generation started to change with the introduction of the Transformer architecture by Vaswani et al. [66], which offered parallel processing and self-attention mechanisms to consider relationships between all elements in the input sequence. The significant number of models being introduced in the past few years and the continual improvements in their capabilities highlight the rapid advancements and the potential LLMs hold for the future [39]. LLMs have been utilised in different ways ranging from simple techniques to advanced and more involved methods. The most fundamental and expensive method is pre-training, where the model is trained on a large corpora of text to predict the next word in a sequence [66]. A widely-used method due to its simplicity is prompt engineering where specific prompts or question are designed to extract desired information or behaviour from the model [28]. With this approach, LLMs can be fed a context or a set of instructions to guide its responses or outputs without traditional fine-tuning. Despite their capabilities, LLMs can generate misleading, harmful, or false content [70]. Therefore, it is important to evaluate them and recognise their shortcomings. Evaluating the output of LLMs is considered a complex process due to the open-ended nature of many text generation tasks. Celikyilmaz and colleagues [13] surveyed the literature on evaluation methods for text generation tasks and their results showed that evaluating the output can be human-centric, with individuals assessing text

quality, or can rely on automatic metrics. Because human evaluations are expensive, researchers tend to use automatic metrics such as stands for the Recall-Oriented Understudy for Gisting Evaluation (ROUGE) [43] to assess the accuracy of the generated text relative to a reference text prepared by a human. To enhance the transparency of LLMs, benchmarks like the Holistic Evaluation of Language Models (HELM) [42] was established to incorporate a taxonomy of desired evaluation scenarios and standardise the evaluation process by examining accessible models under identical circumstances and conditions. Instead of solely relying on individual metrics like ROUGE, HELM evaluates several metrics involving linguistic capabilities of LLMs like efficiency, bias, toxicity, and more. [42]. Still, due to the shortcomings of automatic measures, human evaluations are considered the gold standard in evaluating the generated text [13]. Broadly, human evaluations can be categorised as intrinsic which evaluates the inherent quality of generated text and extrinsic which measures the system's effectiveness in a real-world task. While extrinsic evaluations provide the most actionable insights, they are harder and more expensive to conduct than intrinsic evaluations [13, 65]. To assess the success of the language model using extrinsic measures, the user's success i.e. the benefits users gain from the system, should be considered [13]. This can be evaluated qualitatively or quantitatively. The latter is difficult to achieve since there is no reliable questionnaire for evaluating the generated text. This is due to the fact that the criteria would be domain-dependent. Instead, qualitative data although expensive to acquire and time-consuming to analyse is preferable [64]. In this project, the quality of the generated text depend on the BDEs perception and how it may facilitate decision-making for the BDE and the client. Therefore, the approach to evaluating the generated text would depend on qualitative measures collecting feedback from the target audience.

2.3 User Involvement and User-Centred Design

Users often face their unique challenges and have specific needs and preferences that might not be apparent to developers [31]. By involving users, user needs and preferences can be directly captured and translated into user and system requirements [41]. Bekker and Long [10] highlighted four rationales for user involvement in design: users' ethical right to influence decisions, the benefit of improved system usability leading to work more efficiently and effectively, users' increased commitment to a design they've contributed to, and the belief that designers cannot fully grasp users' work nuances. Empirically [40], the most popular approaches to user involvement in the development

are User-Centred Design (UCD)[51], Contextual Inquiry (CI) [34], Ethnographic Field Studies (EFS) [35], and Participatory Design (PD) [47]. The cost is a determinant factor in deciding which approach is suitable for a project. Among these approaches, UCD is the most cost-effective. [10]. The philosophy of UCD has been shaped by numerous contributors from fields such as psychology, design, and human-computer interaction. Most notably, the seminal work of Don Norman has pushed towards a design that is centred around how users think and behave, rather than forcing users to adapt to the design [51]. Gould and Lewis [31] laid the grounds for UCD and usability by proposing three key principles for usability design: Early and continual focus on users, empirical measurement, and iterative design. By including users early and throughout the development process, users can instil their knowledge and concerns. Using empirical measures such as prototypes to collect and use quantitative and qualitative data can inform design decisions. Insights from Elveruma and Welo show that prototypes can enable exploration of various concepts, lead to reduction of uncertainty, and provide details to gain a deeper understanding of requirements [19]. By adopting an iterative approach to design, designers are more likely to build a product that is usable by the end-users.

By placing BDEs at the centre of the attention, it is more likely that users' challenges will be addressed and their needs will be met, leading to an effective and usable tool. In this project, BDEs are involved in three stages: eliciting requirements, informative design, and summative evaluation. In the first stage, BDEs instil their knowledge in the design while in the latter two, they perform evaluations of the design with the purpose of capturing more of their needs and preferences to refine the design.

Chapter 3

Pre-design Study

This chapter describes the pre-design study which was conducted to address RQ1 and RQ2. Specifically, section 3.1 describes a an initial meeting study with exploratory data analysis that contributes to answer RQ1.1 and inform the design. Section 3.2 describes the study that addresses RQ1.1 as well and contributes to answering RQ1.2 and RQ2.1.

3.1 Initial Interview

The project was initiated by two BDEs working at the Bayes Centre, Edinburgh Innovations' hub for Data Science and Artificial Intelligence. To understand the context of the tool and some of the challenges the BDEs face while doing their jobs, I had an initial meeting with one of the BDEs. During the session, the BDE revealed that their primary source of information is the Research Explorer which is the University of Edinburgh's tool for displaying research output, commercial activity and academics' profiles. According to the BDE, the biography should be written in the third person viewpoint with a minimum of 80 words and a maximum of 250. However, they highlighted some of the challenges they face when they use Research Explorer. These challenges include: Insufficient or inadequate information about the academic, Non-uniform structure of information, and academics including non-relevant content such as advertising PhD students, and academics having multiple profiles distributed across multiple platforms. Indeed, when scraping and exploring the data of the Research Explorer profiles, the following was observed:

- There is a total of 7063 public profiles but only 2231 had any word in the overview (biography) section, while remaining 4832 were empty. This translates to 68%

profiles lacking critical information that can help in assessing the academic for potential collaboration.

- The structure of the overview varied considerably whether in length or viewpoint. In terms of words, 758 overviews contained fewer than 80 words, while 697 overviews exceeded 250 words. Sentence-wise, 622 overviews consisted of just one sentence, whereas 659 had more than 15 sentences, (15 is a threshold set to indicate a potentially excessive number of sentences). Given the total of 2231 overviews, about 34% of overviews have fewer than 80 words, approximately 31% exceed 250 words, about 28% consist of just one sentence and roughly 30% have more than 15 sentences. From the viewpoint perspective, there were 803 overviews written with the first person viewpoint while 640 were written in the third person viewpoint. The rest which is 788 was classified as 'unknown' were either too short or contained a mix of both viewpoints. Given the 2231 overviews, only 29% use a third-person narrative which is the way to write biographies as expressed by the BDEs while 71% adopt either first-person narrative or their structure was unknown, which in either case not recommended for a biography.

3.2 Pre-design

The objective of the study is to elicit requirements for the profile generation tool. The requirements are specified by understanding the use context, BDEs pain points when using existing tools, and identifying their needs.

3.2.1 Participants

The pre-design study including the meeting with the BDE who proposed the project and the semi-structure interviews included six participants from Edinburgh Innovations. Though they belong to the same organisation, they represent a diverse group of individuals, tasked with various responsibilities. Table 3.1 presents an overview of the participants' roles and areas of expertise.

3.2.2 Method and Procedure

Other than the initial interview, I conducted semi-structured interviews with predefined questions and estimated follow-up questions [58] which are provided in Appendix

Table 3.1: Roles and Expertise of Participants in the Pre-design Study

ID	Role	Expertise Area
P1	BDE for Energy Systems	Energy and Engineering
P2	BDE within the School of Biology and Chemistry.	Biology and Chemistry
P3	Innovation Lead for Ag-Biotech at the Roslin Institute	Community Engagement and Data-Driven Innovation.
P4	Commercial subsidiary	Arts, Humanity and Social Science.
P5	Business Development Manager	Social Responsibility
P6	BDE at the Bayes Centre	Data Science and AI
P7	BDE at the Bayes Centre	Data Science and AI

C.1. Questions were mostly open-ended with one question asking participants to rank information such as name, image, etc. Types of questions varied between grand-tour which guides me through the work domain of the users, explaining its key concepts, and case-based questions with example and personal experience questions [68].

Interviews were conducted remotely via Microsoft Teams, given participants' familiarity with virtual meetings. The interview structure, inspired by [27], consisted of three stages: opening, middle, and concluding sections. In the opening section, after informing the participants about the project and the this study and getting their consent, I asked them about their roles, responsibilities, and typical requests they receive, allowing them to share their experiences. This led to more specific questions about the tools they use, their challenges communicating with external partners, and their needs. The middle section was focused on their daily work routines, including current workflows, decision-making, and information required to evaluate academics for projects. This stage aimed to gather detailed insights into the user needs, narrowing down to specific user requirements. In the concluding section, I worked towards wrapping up and asking participants if they had any final thoughts on their expectations of the tool.

Data collection and analysis

I used the six-step guide for performing Thematic Analysis [11] to identify and analyse patterns within the data I acquired from the interviews. The audio recordings were transcribed and textual data was coded using a hybrid approach of deductive and inductive coding [11]. In deductive coding, the identified challenges from the initial interview including: 'insufficient information', 'outdated information', 'non-relevant

information', and 'multiple sources of information', were used for coding. Other pre-defined codes included the specific pieces of information as interviewees verbalised their thoughts about each of them, including 'name', 'job title', 'image' . For the inductive coding, some topics emerged from the data, including roles, responsibilities,, 'maintaining and disseminating information', 'inconsistent information', and 'usability needs', 'ways of communication with academics or companies', 'academics and companies' interests in projects', 'word of mouth', 'Research Explorer', 'OpportunityMatch', 'IRM', 'LinkedIn', 'Google', 'Google Scholar', and 'PubMed'.

3.3 Results and Discussion

The following themes emerged from data: 'Challenge', 'Need', 'Data Source', 'Profile Information', and 'Biography'. Appendix C.2 provides a breakdown of the codes and corresponding themes along with representative text excerpts.

Challenges: This theme encompasses several issues the Edinburgh Innovation employees face to find potential academics. P4 highlighted that there is a lack of sufficient information in the existing profiles,stating:*"some don't have anything, any detail at all."*

The challenge of outdated information was evident in several occasions including P5's comment about social media:

> *"If people don't use them or they use them very irregularly and they're poorly managed, then actually it can be detrimental."*

P3 elaborated on Research Explorer's outdated information by stating, *"When I have used it in the past I found it still had people on the system that have left the university."* Regarding the usability of tools, P5 highlighted the inefficiency in the current information management system: *"It's a question of whether that process could be more efficient, if there was a way automating that."*

The challenge of maintaining and disseminating information was evident from another statement by P5:

> *"I'd really like us to improve the way we curate information about our academic capability, how we maintain that and how we disseminate that both internally and externally."*

Inconsistency was another problem, highlighted by P5: *"quality and consistency is an issue in people's profiles."*

Needs: This theme refers to a requirement that needs to be met or a gap the tool should fill. As the interviewees were speaking about the challenges they face, they tended to suggest solutions to mitigate them. For instance, P5 suggested that Profiles should be customisable, stating:

> *"I would usually refer back to the academic to ask them to either write something if it's needing to be very tailored to the problem... or I'd ask them to check what I'd written."*

P2 suggested by the remarks: *"2 or 3 paragraphs, top-level outline, like an abstract or an executive summary."* that the profile should include an adequate summary of the academic's background and work.

For the presentation of the profiles, P5 suggested the structure of a Curriculum Vitae (CV) as it presents the academic professionally and most companies and organisations are familiar with the template, by commenting

> *"It's the more or less standard requirement to provide short biographies and sometimes even CVs for people which again have to be tailored."*

P3 and P4 touched upon the topic of research themes suggesting they should be presented as a list of tags to make it easy for the reader to understand the academic's expertise. P3 commented: *"There should be metatags identifying specific research interests"*. P4 suggested that publications and projects should be represented as tabs in a tabbed menu as it allows users to flip between the two. P4 explained this feature by saying:

> *"... They have the profile with the links to the projects and then they have a second tab which is the publications and you can then flip between them."*

P5 touched upon the issue of verifying with academics suggesting there should be a mechanism for verification that does not cause bother the academic. Highlighting the inconvenience of the current system, P5 stated:

> *"If there is a database that I could draw from. I wouldn't have to go to somebody and ask them have anything changed in your biography since the last time I spoke to you..."*

Data Sources: This theme describes any source of information the BDEs use to find academics and assess their suitability for a potential collaboration with a client. Across the interviews, there was no source of information to single out as the most reliable but among the most frequently mentioned was the University of Edinburgh pages. P6 explained the school page's value by noting, *"Then, if it's a project within a school,*

quite often there might be details of it.". However, P3 commented on the inconsistency of information, pointing out:

> *"People don't keep their web pages up to date in the university and they don't necessarily have a profile within the university."*

Three participants (P1,P2, and P3) indicated their preference towards using Google with P2 stating "I use Google a lot. It's free. Google is very powerful."

Participants had varying opinions about the role and utility of LinkedIn. P5 highlighted the value of the platform in professional settings, noting:

> *"It's certainly something that the communications and marketing team have seen value in and so they have invested in is LinkedIn training..."*

However, P3 expressed skepticism about its widespread adoption among academics, stating: *"I don't think LinkedIn is a particularly well-used platform by many academics."*

When asked about the Research Explorer, being the University of Edinburgh's main tool for tracking research activities at the university, participants mostly agreed they would not rely on it for finding comprehensive profiles with P2 stating they stopped using it:

> *"When I have used it in the past I found it and it still had people on the system that have left the university."*

Although several sources for data were mentioned such as Research Explorer, OpportunityMatch, school pages, LinkedIn, and Google, the latter was the most cited as the best source of information, suggesting the tool should use it when pulling information to generate the profiles.

An interesting topic that emerged was the reliance on word of mouth as a source of information about academics with remarks such as:

> *"I will try to speak with colleagues through word of mouth to know ... who's doing what, but it's a very manual process, very time consuming."* (P5).

Though the relationship may need time to build up as expressed by one of the participants, the Edinburgh Innovation staff can be the direct line for finding a suitable academic.

Profile Information: This theme encompasses participants' views of the information to appear in the profile. During the interview, participants were shown different pieces of information and asked to rank them according to their importance level. Figure 3.1 shows a heatmap of the responses made by the six participants (P1-P6).

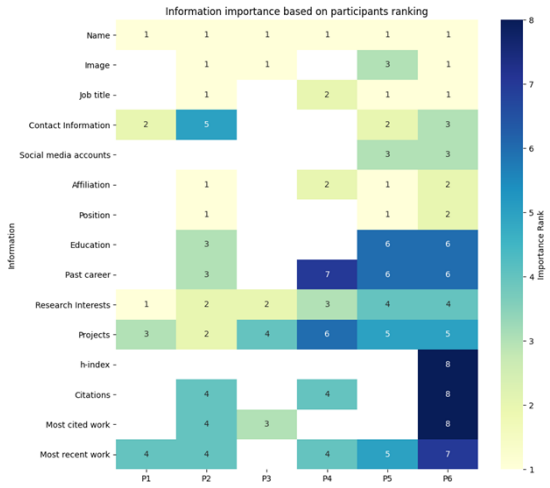

Figure 3.1: Information importance based on the participants (P1-P6) ranking. The numbers (1-8) indicate the level of importance where 1 (light yellow) is the most important and 8 (dark blue) is the least important. white space is used for information that was not ranked by the participant.

Across all the information provided, the majority agreed that the name and research interests are highly important to include in a profile. Participants also had an agreement on the h-index being non-relevant. Apart from this agreed-upon information, views on the other information varied considerably, suggesting these elements may need to be customisable in the generation tool according to users' needs. For instance, P1 and P3 did not even rank the job title, position, affiliation, education, and past career as they did not consider them relevant to external partners. They based their views on that "interested parties aren't bothered by how senior the people are" (P1) and that "They care about them now." (P3). Though education and past career mainly were not applicable, P2 and P6 who have ranked them have set them at a higher level than other pieces of information.

The incorporation of the academic's image in the profile was an interesting topic. Four participants thought it should be incorporated because it would humanise the profile. Among the supporters of this view, P3 stated:

> *"... Because people work with people. At the end of the day, people do like to see a picture of the person that they think they might be working with".*

P5 did not rank the image at the top level stated that *" It's helpful if you're mixing with 100s of colleagues . . . , or you're expecting to meet someone in person,. . . you would be able to pick them out."*

Social media accounts were only applicable for two participants considering them

important. However, throughout the conversations, four participants mentioned LinkedIn as a potential source of information and a way to promote academics if they train on how to present themselves.

Regarding an academic's output, the majority thought 'projects' and 'most recent work' were important to understanding what academics can do and how their knowledge and practical experience can translate into potential collaboration with an external partner. P3 reasoned about the importance of projects, stating *"They need to apply it [research] into the commercial entity."* P5 emphasised the importance of having the most recent work and projects, stating:

> *"So you're saying, what does this person do? And here are some illustrative examples. So, I would have those two things working in tandem".*

Unlike recent work, 'most cited work' and 'citations' have received significantly less enthusiasm, but P6 remarked that they could be beneficial from a prestigious point of view, stating: *"... I guess companies may be impressed with that sort of thing".*

Biography: This theme refers to the summary highlighting various aspects of the academic's life and work and it includes qualities of biography that may appeal to external partners. Notably, 4 participants expressed that it should be clear and concise. P2 explicitly stated: *"The broader point is it has to be concise and clear."* and that *"people are busy and they don't want to read an essay."* In terms of the language and clarity, P5 adviced to *"use plain English," adding the need to "avoid using acronyms [and] any technical terms..."*. However, P2 critiqued that, stating

> *"If you're reaching out to a company that has expertise in a particular field. putting it in layman's terms isn't the best. You want to make sure it's at a technical level that they understand."*

Evident by the six interviews, there was a wide range of responses to the challenges that BDEs face and and what constitutes a good academic profile and biography. The challenges include:

- Existing tools do not provide enough detail for decision-making.
- Information on platforms is not up-to-date, making it less reliable.
- Inconsistency in the quality of information across different profiles.
- Available tools for managing academic information are not user-friendly.
- Current tools are inefficient in maintaining and disseminating information about academics.

Addressing these challenges requires a balanced approach of automation and human intervention. While automation can enhance efficiency, particularly in managing and updating academic data, the evident variation in how potential users rank academic information shows the need for user-centric customisation. Therefore, any solution should not only focus on the power of automation but also prioritise the human aspect, allowing BDEs to tailor academic profiles according to diverse preferences and needs.

It can be concluded from the diversity in opinions about the information to include in the academic profile should be customisable according to the needs and goals of the BDE and the external partners. Accordingly, the tool should be built should be designed with a degree of human intervention as creating profiles that tailor to the audience's need is subject to the employees judgement and understanding of their clients.

User requirements for the tool can be inferred from users' comments on their needs, what information to include in the profile and the characteristics of a good biography. The initial set of requirements include:

- The profiles should offer customisation options, allowing the BDEs to exclude non-relevant information, add extra information, and adjust the biography's structure or style to fit the preferences of a potential client.
- The structure of the profiles should resemble a CV, providing a professional representation of the academic.
- The research themes of an academic should be presented as a list of tags to allow readers to quickly understand the academic's main areas of expertise.
- The publications and projects should be presented in a tabbed menu format to allow users to easily navigate between an academic's projects and publications.
- A verification mechanism should be placed to verify the information in an academic's biography without frequently disturbing the academic for updates.
- Profiles should include a summary describing the academic's background and work. The biography should be clear, concise, and should speak to the level of the target audience.

Chapter 4

Low-fidelity Prototype and Formative Evaluation

This chapter provides the formative evaluation and addresses RQ2 and its two sub-questions RQ2.1 and RQ2.2, and is divided into two sections: prototype design in section 4.1 and its evaluating with BDEs in section 4.2.

4.1 Prototype Design

The pre-design results revealed that users varied on profile information preferences. The lack of consensus is an informative result demonstrating that the tool should allow users to customise profiles. One way to validate identified requirements and elicit more requirements is to run formative evaluation where users can explore a prototype representing the functionality of the tool.

4.1.1 Justification

Prototypes vary from basic low-fidelity mockups to interactive high-fidelity versions [60]. Early on, low-fidelity designs ensure the UI supports essential functions without focusing on visual aspects. Furthermore, using executable mockups which are more advanced than basic paper sketches, but do not require the investment of a high-fidelity prototype, can be revealing because it allows users to interact with the tool and perform a hands-on evaluation from the very beginning of the development process [23].

The aims of the formative evaluation are to explore, communicate, and validate ideas with users before investing time and effort in the more detailed design. Even in

their simple forms, low-fidelity prototypes offer users a tangible way of understanding how the profile would be constructed and presented, and what features the tool will offer.

Website builders such as Wix [67] and Mobirise [46] offer users the option of building a website from scratch by adding elements or using a pre-defined template and adjusting its elements as needed. This idea inspired the philosophy for designing the tool. Broadly, the tool can support users in building profiles either from the top-down in a subtractive approach or from the bottom-up using an additive approach. In the subtractive approach, users start with a complete profile that displays all possible information, and then remove the parts that they do not want. In the additive approach, users start with a blank profile, and they select and add the components they want to appear in the profile. To explore which one is more preferable to users, I created mockups of the two design approaches. There are various available tools for creating prototypes. Popular choices include Balsamiq [8], Figma [22], Axure [7], and Adobe XD [62]. In particular, Balsamiq is designed to create prototypes that intentionally look like rough sketches, which helps keep the focus on functionality and information, rather than aesthetic details [23]. From the designer perspective, Balsamiq offers an extensive library of UI elements, making it quick and easy to create prototypes. For these reasons, I used Balsamiq to create the two prototypes: one using the subtractive approach and the other the additive approach.

4.1.2 Design Overview

The first page the users land on introduces the tool briefly and allows users to search for the academic, as shown in figure 4.1. After entering the academic's name and clicking on the search button, the user is directed to the next page based on the prototype used. In the additive prototype, the user is directed to a page with a prompt to select/deselect the information to include/exclude as illustrated in figure 4.2.

In the subtractive prototype, the user is directed to a fully populated profile with a remove icon (cross symbol) next to each piece of information to allow for its removal from the profile, as depicted in figure 4.3. When the 'Profile Preview' button is clicked, the profile will be displayed as is without the remove icons. The profile design adopts a CV format based on pre-design interview feedback and has four sections. The first section displays basic details like name, job title, image, affiliation, position, and contact. The second features a modifiable biography overview. The third provides

a brief timeline of the academic's career and education. Since the conclusion about including the education and career was not conclusive in the pre-design interviews with some participants rating it in higher levels of importance, it was important to show the users how it fits in the profile to elicit more conclusive evidence on whether or not it is important to include them in the profile. The fourth section highlights the academic's recent work, showing three publications and projects to prevent information overload.

In both prototypes, the overview includes buttons to regenerate the overview and edit it shown as icons above the overview. When the user clicks on the filter icon, a pop-up appears asking the user to select between a general or knowledgeable audience, neutral or formal tone, and detailed or brief overview, as shown in figure 4.4. If the user clicks on the edit option, a pop-up with a text-area allowing the user to edit the text manually appears, as shown in figure 4.5. The tool also allows users to verify the profile information by sending an email to the academic with a template message that can be edited as shown in figure 4.6. If the user is satisfied with the profile, they can send it to the external partner using 'share with external partner' button, as shown in figure 4.7.

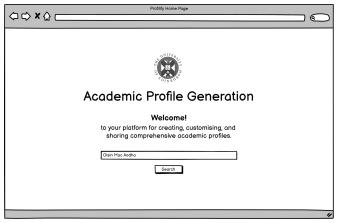

Figure 4.1: Home

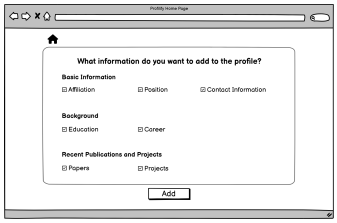

Figure 4.2: Add content

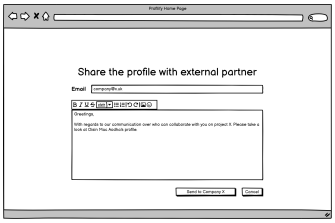

Figure 4.3: Share profile

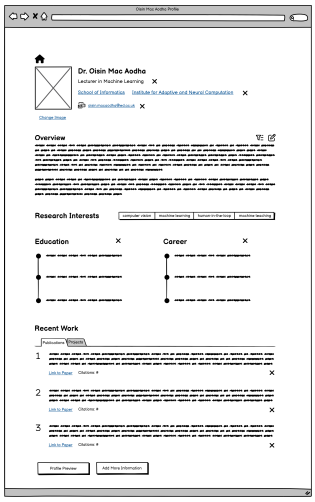

Figure 4.4: Academic Profile Screen in the subtractive Prototype

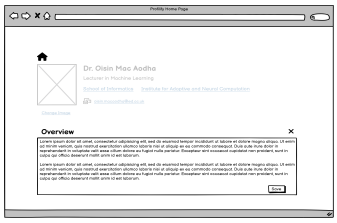

Figure 4.5: Tune overview

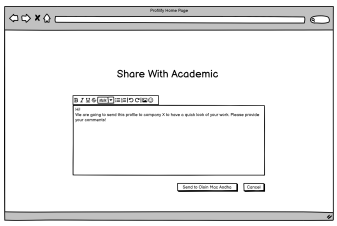

Figure 4.6: Verify Profile

Figure 4.7: Share profile

4.2 Prototype Evaluation

4.2.1 Aim

The aim of evaluating the prototype was to get users' feedback on the design of the profile, introduce a set of features the tool can offer and run usability evaluation to identify major problems with the design as well as suggestions. These tests can provide valuable insights and can help elicit more requirements to guide future design iterations.

4.2.2 Participants

Six Edinburgh Innovation employees volunteered to participate in the study. An overview of the participants is provided in Table 4.1. While having more participants can provide more diverse feedback and help uncover a greater number of potential issues, each additional participant also incurs extra costs. Therefore, having 6 participants was suitable to run the prototype usability tests. This aligns to some extent with the recommendation to recruit only five participants suggested by Nielsen and others [49]. They suggest that 85% of usability problems can be uncovered with just five users and that there will be diminishing returns after the fifth participant because each additional user is likely to uncover fewer new problems, while the cost of recruiting and testing each user remains constant.

Table 4.1: Participants in the Formative Evaluation

ID	Role	Participation
P1	BDE at the School of Geo-Science	First Time
P2	Innovation Lead for Ag-Biotech at Roslin Institute	Pre-design Study
P3	BDE within the School of Biology and Chemistry	Pre-design Study
P4	Consultancy Manager for College of Science and engineering	First Time
P5	BD Manager for Social Sciences and Sustainability	Pre-design Study
P6	BDE at the Bayes Centre	Pre-design Study

4.2.3 Methods and Procedure

The evaluation combined the Think-Aloud Protocol (Script in Appendix D.1) [20, 21] with brief follow-up questions (In Appendix D.2). In the Think-Aloud session, users tested both prototypes while expressing their thoughts. I chose an interactive approach to conduct Think-Aloud Protocol[69]. In an interactive style, the evaluator can probe users with more than simple 'keep talking' probes and can help them when they are stuck [45]. Interactive Think-Aloud increases the number of relevant responses, and participants' recommendations were found to be helpful in understanding the root causes of problems [69]. It can also creates a more comfortable environment for participants, making the participants feel that their opinions are valued and encouraging them to share more thoughts [21, 45, 3]. During the session, users were asked to perform a set of tasks for each prototype. In total, there were five tasks associated with the subtractive prototype and six with the additive prototype. Appendix D.1 and D.2 show the breakdown of tasks, duration per participant, and success rates for the Subtractive and additive approach, respectively. The tasks were test the core functionality of the proposed design and were similar in both prototypes to allow for comparison between the two approaches. The tasks include generating a complete or customised profile, sharing the profile with academic or external partner and refining the tone of the overview. The latter has the same design and placement within the same page in both prototypes, therefore it was tested in the one prototype only. The follow up questions which are listed in appendix D.2 allowed me to ask users for their direct feedback on which prototype they preferred and their overall experience with the prototypes. The questions involved the prototypes' differences, ease of use, challenges, and overall layout and information order.

All sessions were conducted using Microsoft Teams and they started by introducing the Think-Aloud protocol to participants. Once participants confirmed they are ready,

I sent the prototypes and asked them to perform associated tasks. The presentation order of prototypes was randomised, to reduce the order-effect bias [54]. P1, P2, and P6 started with the additive prototype first, while P3, P4, and P5 started with the subtractive one. After the evaluation of the 2 prototypes was done, I asked participants the follow-up questions.

4.2.4 Data Collection and Analysis

Similar to the pre-design study, sessions were video-recorded and audio transcribed using MS Teams. Thematic Analysis was employed to analyse the data and get users' feedback on the proposed design and functions, identify usability problems and find out which approach for building profiles they prefer. Coding the text acquired through Think-Aloud sessions can be time-consuming, but to make the data more manageable, I made use of a pre-defined framework used widely in usability tests which include the sub-themes: 'navigation', 'layout', 'content' and 'functionality'. The 'navigation' theme includes issues in navigating between pages or identifying links. The 'layout' theme includes problems caused by confusing web elements, visibility issues, and inconsistency. The 'content' theme involves problems related to the information displayed whether it is unnecessary or absent information and problems with the terminology and dialogue. The 'functionality' theme includes absence of necessary functions and the presence of problemtic functions [4]. Also, another theme representing 'more user requirements' emerged from the data while performing the analysis. I also recorded users' task completion time, and categorised usability problems according to their frequency and impact on task completion. The frequency refers to how many users encounter the same problem [32]. The impact indicates the effect of a problem on a user's task completion and it's classified into four categories: Critical (prevents task completion), Major (causes significant delay or frustration), Minor (causes slight delay), and None (no delay but with enhancement suggestions) [4]. Theoretically, the severity rating of a usability problem is calculated as the sum or multiplication of the impact, persistence, and frequency with labels corresponding to the severity levels. Yet, in practice, ratings are not strictly mathematical with evaluators often considering factors like user feedback and real impact for their judgements [32]. Also, persistence which measures how many times a single user faces the same problem when interacting with the system [32] was a non-relevant metric, since all tasks include distinct steps with distinct elements to use. Accordingly, although the frequency and the impact contributed to the severity rating, it

was not through summation or multiplication, but through evaluator judgment. I utilised Nielson's severity ratings: 0 for no usability issues; 1 for cosmetic issues fixed if time permits; 2 for minor issues with low priority; 3 for major issues with high priority; and 4 for critical usability flaws needing immediate attention before tool release [48].

4.3 Results and Discussions

Tasks Analysis and the Winner Prototype

To measure the overall task performance, the time spent on tasks and the success rate were calculated. The task success rate measures the percentage of tasks that were completed successfully by users and provides a clear indicator of whether users can accomplish their goals. Detailed results of the task performance are provided in figures 4.8 and 4.9. In 8 out of the total 11 tasks given, the success rate was 100%. The duration of performing tasks ranged between 2 to 95 seconds in the subtractive prototype and between 2 to 114 in the additive one.

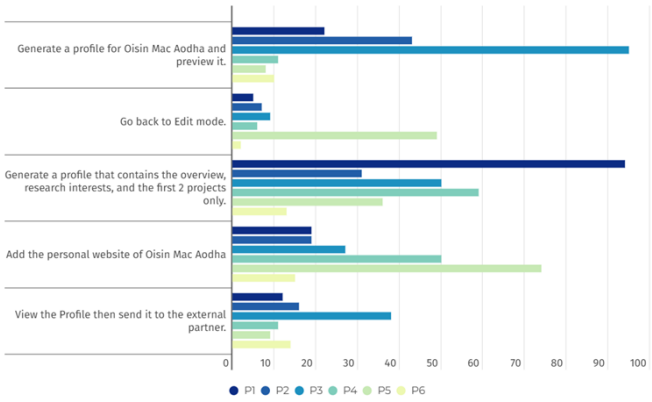

Figure 4.8: Time per task by participants (P1-6) in the subtractive approach

Participants' interaction with the tool varied based on the task and prototype approach. In the subtractive approach, all participants were able to generate the complete profile successfully. Yet, only P3 and P6 used the 'preview' button to go to the preview mode as instructed in the task, while the others mistakenly believed they were already in preview mode. This indicates that the edit mode should not be the default. In the task where users were asked to generate a profile with specific information, P2, P3, P5, and P6 were successful in finishing the task but P1 and P4 failed to remove the information that is not required, indicating the choice of using the 'cross' icon for removing information is not intuitive for some users.

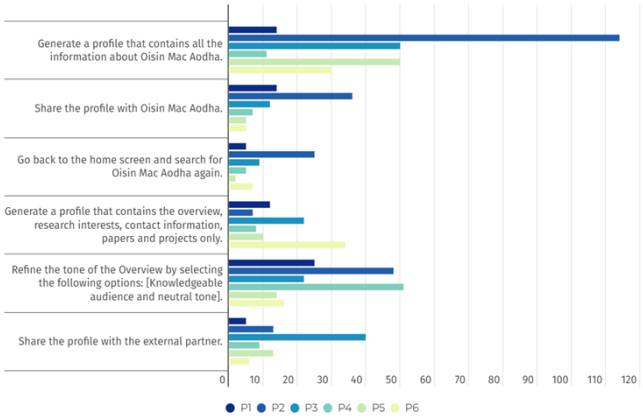

Figure 4.9: Time per task by participants (P1-6) in the additive approach

On the other hand, in the additive prototype, the success rate of the first task where users were asked to generate a full profile was 100%. Comparatively, in the task where users were asked to generate a profile with specific information to include, the success rate was 83% with all participants, except for one, confidently finishing the task. P1 who did not complete the task successfully added the education and career because she assumed they are part of the overview.

Task performance does not clearly show which prototype is more intuitive due to similar times and success rates. However, when focusing on full and tailored profile tasks, users took longer with the additive prototype (14-114) but felt more confused in the subtractive one, despite having shorter durations (8-95).

Based on the short interview conducted after the Think-Aloud session questions, P1 and P4 favored the additive approach and P2 and P6 leaned towards the subtractive one while P3 and P5 found both equally easy. P1 reasoned about her choice stating: *"I could select the things that I would know I need for proposal I'm writing."*, while P4 thought the approach was more *"user-friendly"*. For the supporters of the subtractive approach, P2 stated: *"Certainly the second [subtractive] one seemed easier."*, while P6 stated:

> *"I think the second version is more intuitive in the sense that you're seeing the full profile and then editing out the bits that you don't want to see based on your customer and what you think that they might want to see."*

For the participants who did not favor one over the other, P3 completed all tasks successfully in the two prototypes within a reasonable time frame. However, he did not grasp the difference between the two prototypes stating:

> *"Even though I just spent half an hour looking at both, I can't consciously think of any noticeable differences".*

P5 was almost successful in all tasks with the exception one task, but she was able to grasp the difference between the two approaches. Yet, she could not make a decision on which one is more intuitive for use.

Since the evidence is not conclusive on which prototype is more intuitive or preferable, it follows that tool should accommodate both approaches. The subtractive approach would be quicker for users who prioritise time and the additive one would be easier for those who prefer knowing what would go in the academic profile before displaying it.

Usability of the Proposed Designs

Using the predefined framework for detecting usability problems which include navigation, layout, content, and functionality, 21 issues were identified in both prototypes ranging from from enhancement suggestions to major problems. Table 4.2 provides a summary of the usability problems, frequency, impact and the severity rating. The severity rating was expressed as a combination of the frequency, impact, user feedback and other factors.

In the 'navigation' sub-theme, users' inability to distinguish between 'Preview' and 'Edit' modes in the subtractive prototype was ranked 'major', because five out of six users faced it and they were not able to complete the task until probed to complete it. However, the problem can be mitigated by changing the default mode.

In the 'layout' sub-theme, one issue concerned web elements due to poorly chosen icons for overview regeneration options. This major issue, faced by three users, can be resolved by updating icons or redesigning the overview section. The other two display-related problems were cosmetic, because they did not cause any impact on the completion of the tasks and reported by only 1-2 users.

The 'content' sub-theme had the highest number of occurrences in the data with 12 issues identified in total. Seven problems concerned language use, like dialogue and terminology inconsistencies, and were minor as only 1-2 users noted them without affecting task completion.

Within the 'functionality' theme, 4 issues were recorded: 1 problematic function and 3 missing functions. Though reported by 1-2 users and having minor impact, they were rated from minor to major in severity. For example, selecting formality and length levels was highlighted by 2 users. This is due to P1 and P5 commenting: *"I can't imagine there's different formalities needed"* (P1) and *"I don't know what would that feel.. the difference between neutral and formal. I think a lot of what we do is both of those things."* (P5). These remarks suggest that a neutral/casual tone is not applicable to the BDEs. Similarly, after looking at the populated profile, P5 commented that the

Table 4.2: A breakdown of the 'usability' theme and its sub-themes

Sub-theme	Code	Problem	**Frequency**	**Impact**	**Severity Rating**
Navigation	Home Icon	Failure to identify the home icon.	3	Minor	0
	Preview/Edit	Failure to differentiate between the 'Edit' and 'Preview' modes.	5	Major	3
Layout	Web elements	Icons for Edit Overview and Change properties do not reflect their actions.	5	Minor	3
	Display	Gaps appear when removing some information in between other pieces of information.	1	None	1
		The publication tab has less importance than the project tab but it is the active tab when the page is loaded.	2	None	1
Content	Absent information	Academic's skills	1	None	1
		Academic's Achievements	2	None	1
		Social media accounts	1	None	1
		Webinars delivered by the academic	2	None	1
	Unnecessary Information	Education and career are considered unnecessary.	1	None	0
	Terminology	'Search' does not reflect the action to generate the profile.	1	None	2
		'Share with academic' does not reflect the action of verifying with the academic.	1	None	2
		'affiliation', 'position', 'career' are considered vague terms.	1	None	1
		Difference between 'Neutral' and 'Formal' is not clear.	2	Minor	2
	Dialogue	Message to external Partner does not contain a call to action.	1	None	1
		Message to Academic does not contain the name of the academic.	1	None	1
	Inconsistency	'Share with the academic' in one page and in the other 'Send to Oisin Mac Aodha'	1	None	2
Functionality	Problematic Function	brief vs detailed and neutral vs formal tone for the overview are subjective and may cause unwanted consequences.	2	Minor	3
	Absent Function	Adding a subject to the message that would be sent to the external partner.	1	Minor	2
		No log to record who has created the profile.	1	None	3
		No option to remove the image.	1	None	2

overview was already of proper length, stating: *"It's the right sort of length as I would be expecting for an for an overview section"*. Another issue was the lack of a subject line when sharing, as P1 commented: *"I'd rather have some control over what it is the subject says because I think if this just said like 'academic profile' they will probably put is as a spam"*. The tool also lacked a way to audit profiles. P4 suggested to enforce the verification with academics, stating: *"I don't know whether the workaround for that is to always have it validated rather than giving the option to send it freely."*. However, this might be inconvenient for the academic and the BDE, especially for minor changes or during the academic's absence. A better approach would be to save profiles with creator details and timestamps to ensure accountability. Lastly, P6 highlighted the absence of an option to remove an academic's image, stating:

> *"You should also be able to cross on the picture because obviously if someone doesn't have a picture uploaded that can sometimes create a bit of inconsistency."*

Optimistically, users provided positive remarks which validated the identified requirements and can guides the design of the high-fidelity prototype, including:

- Users found the prototypes intuitive and easy to understand with remarks such as: *"I think it's really intuitive"* (P1) and *"anybody who is familiar with software or websites should find this relatively straightforward"* (P3).

- Users appreciated the layout and content organization with comments such as: *"I think overall the layout is good"* (P5) and *"it's a very clear and well-worked-out display of the individual's information and CV"*(P3).

- P1 who did not participate previously revealed that the tool fulfills their needs, stating: *"I think it's a brilliant tool. I think it's exceptionally needed."*.
- Though the prototype was of low-fidelity, some users appreciated its visuals with comments such as *"quite nice and clean"* (P4) and *"I quite like that layout. Very simple, very easy to see"* (P1).
- The design encourages users to adopt a standard format as suggested by a remark from P1: *"Gets everybody doing it in the same format"*.

Additional user requirements:

Introducing the tool in a tangible form combined with new participants joining the project, gave rise to more requirements for the tool:

- The tool should provide more options for other types of information such as videos, indicated by P1's comment: *"It would be helpful to add links to, for example seminars (videos)..."* and P4's remark: *"I would hope that could be added ... a webinar that they delivered "*.
- The tool should provide an audit trail of profiles created, suggested by P4 sharing their concern: *"[If] I didn't ask him to validate and there was something horrifically wrong in it and he got annoyed, and I'd say: oh, well, that wasn't me!"*.
- The tool should support sending emails with the ability to customise the subject as suggested by P1's remark: *"I would like to see a subject line here."*.

Based on the formative evaluation, users were generally satisfied with the design's navigation, layout, and functionality, indicating the implemented version should maintain this design while addressing usability problems. The lack of conclusive evidence on which prototype to implement demonstrates that there is no-size-fits-all approach to the process of building the profiles, even if the outcome is the same. Therefore, a decision was taken to accommodate both approaches in the implemented version.

Chapter 5

Summative Evaluation

This chapter focuses on the summative evaluation of the tool and addresses RQ3 and its sub-questions RQ3.1, RQ3.2, and RQ3.3. Specifically, it presents an overview of the design and implementation choices, describes the study design and presents the summative evaluation results.

5.1 Design and Implementation Overview

5.1.1 Design Decisions

Several design decisions were driven by the feedback from the formative evaluation and Nielsen's usability heuristics for UI design: Visibility of system status, match between system and the real world, user control and freedom, error prevention, recognition rather than recall, consistency and standards, help users recognise, diagnose, and recover from errors, aesthetic and minimalist design, and help and documentation.

[50]. The core features of the tool are listed below:

- **Search for academics:** Users can search for academics using the homepage's search bar. As users type the name of the academic, auto-complete suggests possible matches to prevent users from misspelling the academic's name, as illustrated in figure 5.1. If users, enter a wrong name, a message with an option to go back to search is shown to them as illustrated in figure 5.2. When users click on the 'Start with Standard' or 'Start from Scratch' buttons, the tool starts pulls information from different sources. Since the process takes a while, users are informed about what is going on through a message with a loading spinner and text asking them to wait as illustrated in figure 5.3.

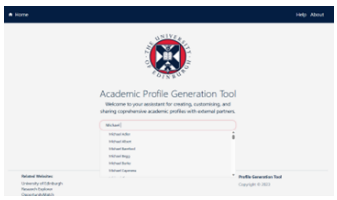

Figure 5.1: Auto-complete

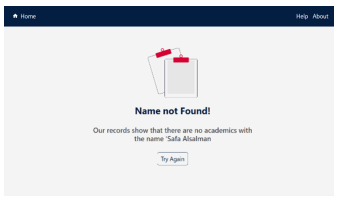

Figure 5.2: Error Message

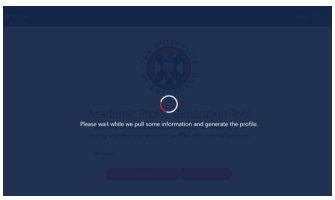

Figure 5.3: Wait Message

- **Start with a Standard Profile:** The option represents the subtractive approach. Information displayed in the profile, as illustrated in figure 5.4, include the name, job title, position, affiliations, image, social media accounts, overview, publications and projects. The profile is displayed in the preview mode first, to avoid the confusion that occurred in the formative evaluation.

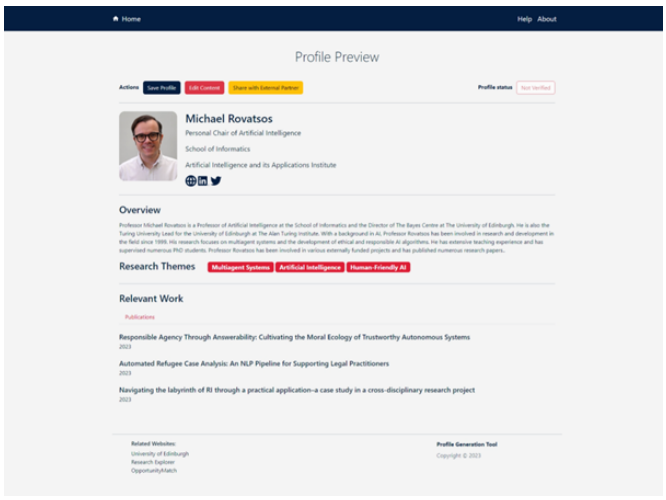

Figure 5.4: The standard profile in the preview mode

- **Start from Scratch:** The option represents the additive approach displaying a step by step wizard for users to choose what elements to add for a more refined profile. Elements include choosing the image, social media accounts, publications, projects, videos, and links to be used in generating the overview. Figures 5.5 and 5.6 show the screens for selecting an image and links as examples.

- **Save and edit:** The profile page includes action buttons for saving the profile and editing its content. If users select to edit the content, the same profile will be displayed but the information will be shown in text fields with a 'bin' icon next to each one. The option saves the profile in a list of profiles associated with the academic as illustrated in figure 5.7. The 'profiles list', shown in figure 5.8, is

introduced as a way for disseminating profiles across BDEs and to keep record of profiles. In the edit content page, illustrated in figure 5.8, the 'bin' icon is used to represent the action of removing information from the profile instead of the 'cross' which caused confusion in the formative evaluation. Users can also change the tone of the overview in the edit page. Given by the confusion the icons caused in the formative evaluation, it was difficult to pick icons that are universal to all users. Therefore, buttons with explicit labels were used instead.

- **Verify with academic and Share with external partner:** The profile status, i.e. verified/not verified is displayed at the top of the page. To avoid annoying the academic with many verification requests, the option for verification is not readily available. When users select to share the profile with a client, they are reminded that the profile is not verified and asked to make an informed decision of whether to verify with the academic or take responsibility for their actions before proceeding, as illustrated in figure 5.9. If they choose to verify with the academic, a page with a populated message that be customises is displayed, as depicted in figure 5.10.

Figure 5.5: Add Image

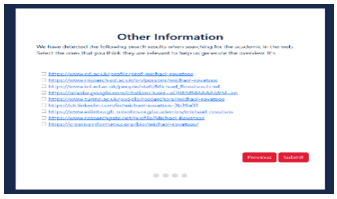

Figure 5.6: Add Links

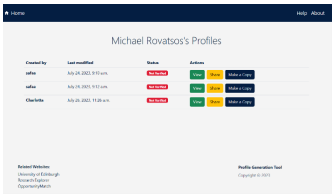

Figure 5.7: Profiles List

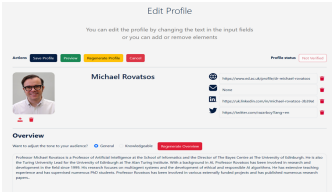

Figure 5.8: Edit Profile

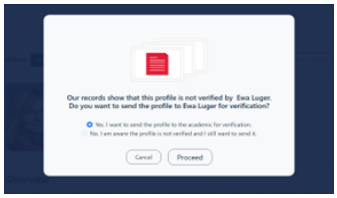

Figure 5.9: Warning

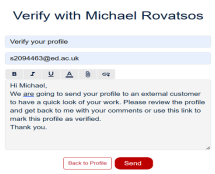

Figure 5.10: Verify profile

5.1.2 Implementation Specifications

The tool is implemented as a web application with a frontend developed using HTML, CSS (with Bootstrap), and JavaScript. Python was selected for the backend for several reasons related to the nature of the project. First, to retrieve data from various sources,

the Python 'requests' package can be used to make HTTP requests via API links [56], and BeautifulSoup [57] can parse the responses. Secondly, the application is built on Django[25], a popular Python web framework that uses a design pattern called Model-View-Template (MVT) which simplifies the database operations [59]. Finally, for overview generation, most LLMs provide APIs that can be accessed using Python.

Profile and Overview Generation

To integrate the information from multiple pages, the job title, position and affiliation are derived from the University of Edinburgh database while the rest of the information is retrieved from the web using SerpAPI. Agents were developed for GoogleScholarAPI, GoogleSearchAPI, GoogleImageAPI, and YouTubeAPI to integrate information into the UI. The Google Scholar Agent fetches the academic's recent publications. Google Search Agent pulls top Google results for the user to select for overview generation in the 'Start from Scratch' option, but the 'Start with a Standard profile' uses the top result directly to generate the overview. Google Image and YouTube Agents retrieve five options each for images and videos.

Due to the large number of deployed and because of time and budget constraints, only the three top entries in text summarisation from the HELM benchmark were selected for experimentation before choosing one for deployment. The attributes that were selected for comparison include accuracy as established in the HELM benchmark, cost as shown in table 5.1. The models, 'TNLG v2' [63], 'Cohere' [63], 'gpt-3.5-turbo-0301' [52] have high Mean Win Rate (MWR) values which translate to winning over other models in the summarisation accuracy metrics. All models perform similarly on the ROUGE-2 metric, with scores close to 0.161. withh 'gpt-3.5-turbo-0301' leading in the 'CNN/DailyMail' dataset, although differences among the models are minimal. Since 'TNLG v2' is closed, it was excluded from further investigation. Running an experiment with a sample of 50 academics, to determine which model would take longer times for generating the overview, resulted in GPT's taking an average time of 5.3 seconds while Cohere took 7.2 seconds on average,though the results depend on how much information is provided to the model. Cost-wise, GPT's cost per token is ten times cheaper than Cohere's cost per token. For all these reasons, gpt-3.5-turbo was selected for the integration with the tool. It is also to be noted that there was already a version of gpt-3.5-turbo with 16k context making it suitable for academics who provide lengthy biographies in their one page. With Cost of 0.003/1k tokens, the chosen model is five times cheaper than Cohere's cost.

Given the different opinions about the technicality of the generated biography in the

Table 5.1: Model Performances and Specifications

#	Model	Mean Win Rate	CNN/DailyMail - ROUGE-2	Cost	Max input tokens
1	TNLG v2	0.96	0.16	Closed	NA
2	Cohere Command Beta	0.93	0.16	$0.015/1k tokens	4096
3	gpt-3.5-turbo-0301	0.89	0.17	$0.0015/1K tokens	4096

pre-design study, three biographies were generated with different prompts:

- **The default:** "Write a concise and clear biography about the academic."
- **The general audience:** "Given the information provided about the academic, write a concise and clear biography about the academic. Make it accessible and ensure the language is non-technical and easy for anyone to understand. Use fully-qualified terms and avoid using acronyms and technical jargon."
- **The knowledgeable audience:** "Given the information provided about the academic, write a concise and clear biography about the individual. The language can be technical and targeted for experts in the field."

5.2 Study Design

5.2.1 Aim

The aims of summative evaluation are to assess the usability and utility of the tool before it implemented at scale, and to collect comprehensive feedback on the accuracy and relevancy of the generated profile and the text quality of the auto-generated biography.

5.2.2 Participants

In total, 11 participants participated in the summative evaluation. A total of eight Edinburgh Innovations employees (P1-8) participated in the usability test. Combined with three external partners (P9-11), the Edinburgh Innovation employees participated in evaluating the profile and the overview. Table 5.2 presents an overview of the participants.

5.2.3 Methods and Procedure

The tool's utility and usability evaluation consisted primarily of Think-Aloud Protocol (Scripts in Appendix E.1 and E.2) with a follow-up SUS questionnaire (Appendix E.3).

Table 5.2: Participants in the Summative Evaluation

ID	Role	Participation
P1	BDE at the Bayes Centre.	Pre-design and Formative Evaluation
P2	BDE within the School of Biology and Chemistry.	Pre-design and Formative Evaluation
P3	Consultancy Manager for College of Science and Engineering	Formative Evaluation
P4	Business Development Manager for Social Sciences and Sustainability	Pre-design and Formative Evaluation
P5	BDE at the College of Arts, Humanities and Social Sciences	First Time
P6	Consultancy Manager at Edinburgh Innovations & First Time	First Time
P7	Business Development Manager at the Institute for Language, Cognition and Computation	First Time
P8	BDE at the Bayes Centre.	Pre-design
P9	External Partner	First Time
P10	External Partner	First Time
P11	External Partner	First Time

During the Think-Aloud sessions, users (P1-P8) shared their comments on the tool's utility and usability. However, instead of asking users to perform specific tasks, they were left to explore the tool on their own, narrating their thoughts while experimenting with the different features. The objective was to get users' feedback in a more natural environment that resembles the real context of use to draw conclusion on its usefulness for the BDEs. A relaxed and interactive Think-Aloud Protocol was employed where users would be guided if they are stuck not knowing what to do for a long period of time. [69, 3]. After using the tool, users were asked to fill the SUS questionnaire which gives an indication of the system's usability. The questions are a mix of positive and negative items, and the participants rate their level of agreement or disagreement on a 5-point scale where 1 reflects strong disagreement and 5 reflects strong agreement. Once users have completed the questionnaire, scores for each participant are summed and converted to a total score that ranges from 0 to 100. This is done by subtracting 1 from the scale of each odd-numbered statement because they represent positive statements and subtracting 5 from each even-numbered statement because they represent negative statements. Then the new score is multiplied by 2.5. In the end, the average of all participants' scores is calculated and represented as the total usability score of the tool.

To assess the profile and the generated overview, users as well as external partners provided feedback during Think-Aloud sessions about the accuracy and relevancy of the profile's information. Users commented over the text quality of the three biographies but external partners only commented on the default biography only because of how the BDEs perceived the other two versions. Because the users expressed their disapproval of the general biography during their evaluation sessions, the general audience was deemed unsuitable for presentation to the external partners. All sessions were conducted using MS Teams with the exception of one external partner who preferred an in-person

meeting. I followed a similar procedure to conducting Think-Aloud sessions as the one in the formative design study (Scripts are provided in appendix E. Once participants confirmed they are ready, I connected them to my desktop to test the tool using the 'Give control' feature in MS Teams. Sessions took 45 minutes on average. After the Think-Aloud session is over, I sent the SUS questionnaire to the users and asked them to fill it out.

5.2.4 Data Collection and Analysis

Similar to the previous studies, Thematic Analysis was used to analyse it. However, the focus on the utility and usability aspects of the tool as well as the accuracy and relevancy aspects of the profile and the biographies. The audio data was transcribed and coded and the codes were grouped into themes. The 'accuracy' theme included the codes 'Accurate', 'Outdated' and 'Wrong'. The 'relevancy' theme included the codes 'relevant' and 'irrelevant'. The 'utility' theme included codes representing the tool's functions: 'Start with Standard Profile', 'Start from Scratch', 'Share with external partner', 'Verify with academics', 'Profile List', 'Make a copy of the profile', 'Edit Content', 'Overall Experience', 'Auto-Complete', 'Choose image/video'. A breakdown of the results is presented in Appendix E.4.

5.3 Results and Discussion

5.3.1 Usefulness of The Tool

According to Nielsen's definition, a useful product has utility and is usable. Utility is a characteristic that describes whether the product provides the features needed while usability is a characteristic that describes how easy and pleasant the features are [50].

Utility: This theme includes codes resembling the different features the tool offers. Users found that the 'Start with a Standard Profile' option fulfils their needs. For instance, P5 appreciated the convenience of standard profile and commented on how the feature reduces the manual work:

> *"That's really good because that's the sort of fiddly thing that we might try to do that. The system has done for us."*

. P7 found it beneficial to have standard profiles when researching academics, stating "this is basically I would expect to use a standard profile when I'm researching the

academic". P8 favored the subtractive nature of the standard profile over the additive one stating: *"If you're building things from scratch, there's going to be less consistency across."* Other users appreciated the 'Start from Scratch' option. For example, P7 stated:

> *"I think that's a pretty good experience actually, because it gives you the ability to do a lot of customisation of the profile for the person that you're sharing it with."*

P4 thought the approach offers insights into an academic's work stating *"You get to learn a bit more about the academic through the process."*

For the 'Share with external partner' feature, all participants appreciated the option to verify with the academic and the warning before sharing the profile with the external partner. P1 remarked that the tool prompts users to think before sharing, stating *"I really like this though, because it does make you double think."*

Verifying with academics was received with appreciation as well with P5 stating *"I think it's really important to make sure that they have approved it."* In the same vein, P8 commented that accuracy is critical before sharing with external partners, stating:

> *"What you don't want to do is send someone a profile that you know there was any doubt that it was not accurate and share it with a third party."*

P4, however, expressed concern over turnaround times for verification stating:

> *"I think one of the issues is around the turnaround times at the moment. For instance, a lot of academics are taking their holidays, so there might be a way for two weeks, three weeks, or they're not on email as frequently as they normally are or during term time."*

This suggests that it is good to give flexibility to BDEs in sending the profile without the approval of the academic, especially if the profile contains minor modifications.

The 'Profile List' feature was received with concern and appreciation. Users expressed concerns with having multiple versions of the same profile. For instance, P3 stated:

> *"I just know how people behave. you'll end up in here with about 50 different profiles, because each person's gonna make their own."*

However, three participants gave suggestions to mitigate the issue. P3 suggested adding tags or comments to distinguish between profiles at a first glance instead of clicking through the profile, stating: *"We need to give them some indication as to the differences of each profile."*

P1 suggested presenting the standard profile to the user, then adding an option to view other profiles on the page stating:

> *"I think it should be that [academic] has a standard profile that's generated automatically and then at the top there should be like view alternative profiles that others have generated."*

On the positive side, P4 appreciated the feature stating:*"Otherwise, I think it's good... having a Bank of profiles that I personally have created."*

Usability: The SUS questionnaire scores ranged between 72.5 and 97.5 with an overall average score of 86.9. According to Bangor and colleagues[9], this score correlates to the adjective 'excellent' in people's ratings of systems. During the Think-Aloud session, several participants expressed an overall satisfaction with different aspects of the tool. The layout and presentation was praised with remarks such as *"That's very neat. It's very nicely laid out."* (P1), and *"I must admit, I do like this. The setup nice and clean."*(P3). P7 explicitly appreciated visual cues to aid the user such as the spinner loading to show the information is being retrieved and the auto-complete functions with remarks such as: *"The spinning wheel...it's useful to know that it's actually doing something in the background"* and *"I do like the fact that it does the look up, so that's a really good."* On the overall experience, P4 who has participated in the pre-design and formative evaluation appreciated the implemented version of the tool stating:

> *"It's a great resource and I can see a lot from the earlier conversations that we've had a lot of the points that I made have been brought in this.".*

5.3.2 Profile and Overview Evaluation

Accuracy: In the Think-Aloud sessions, users searched for 18 academics. The tool generated 15 profiles but failed for 3 due to the incorrect assumption that all academics have Google Scholar accounts, causing the tool to crash. Table 5.3 shows a breakdown of the assessment of the accuracy of the information for the generated profiles. The accuracy of the position and affiliation depends on how immediate the University of Edinburgh updates the information on its management system, as this information was retrieved from its databases. The only way to verify the accuracy of this information is either by asking the management or the academic which is not feasible given the time frame. Out of the 15 profiles, 5 profiles were completely accurate, only 1 profile had an issue in the image, 8 had issues related to their social media accounts, 4 had inaccuracies or unverifiable information in the overview, 3 showed inaccuracies in the research themes and publications.

Across academics, 5 profiles were generated with completely accurate information. The accuracy of their profiles could be attributed to their strong online presence across the different platforms: social networks, Google Scholar, and the University of Edinburgh pages. There were also 4 profiles that were mostly accurate with 1 inaccuracy in the overview or social media accounts. One academic's profile was concerning because it was a mixture of information of 2 academics with the same name, working at the University of Edinburgh. While the overview, research interests, publications and Twitter account were about an academic from the School of Informatics, the image was for one from the Department of Orthopaedic Surgery.

In 3 profiles, inaccuracies were noted in research themes and publications due to SerpAPI selecting the wrong author ID. This happens when two academics on Google Scholar share a name and the tool can't differentiate them using just the name and 'University of Edinburgh'. To remedy this, the BDE can manually select the correct Google Scholar identifier before generating the profile.

In the overview section, 4 profiles had issues with unverified statements, incorrect project names, or less useful details. One mixed project names, another had an unfinished sentence, and a third mentioned the academic's sense of humor. One overview accurately matched the reference, but it emphasized the research group over the academic, reducing its relevance and usefulness.

In general, the profiles were mostly accurate, especially in the image column and with most errors in social media, notably Twitter. Calculating the number of accurate entries out of the total number of entries yields 78% accuracy. By letting users select the right Google Scholar profile, accuracy could rise to 83%. Users can further correct details like social media accounts and should verify profiles with the academic before sharing externally.

During the Think-Aloud sessions, two participants did not mind outdated or inaccurate information. After spotting outdated information in the overview, P1 stated 'So I'm just going to edit the content because he is actually no longer the deputy director of research, ... he obviously hasn't updated that on his profile.' While P5 stated 'of course I would go and check this with Ewa herself to make sure that all of this is still current information because these things just change so quickly...'. With such remarks, it can be inferred that users will not mind editing the profile or verifying its accuracy with the academic.

Relevancy: Relevancy is an extrinsic characteristic of text that depends solely on the target audience i.e. BDEs and external partners. Therefore, it was evaluated either

by asking BDEs what they think their customers are expecting or asking the external partners themselves if they perceive the information as relevant to them. During the Think-Aloud sessions, participants were expressive of their views on the information provided. P5, for instance, commented on the overview with the remark: *"Good. I think that's nice thing for companies to know."* And *"That's really interesting. Glad that's there."* P6 thought it was good to have links to more extensive information, stating: *"And there's plenty of links on there to do more exploring on our on other pages to find even more information out."*. P6 also commented on the overview stating *"...you could definitely get a good sense of what she does."*. External partners (P9-11) were also expressive about the relevancy of the information. While reading the overview, P10 commented on several occasion that certain sentences in the biography were not relevant, stating: *"Well, I don't really care about."* and *"I mean, again, that's interesting. It's not interesting to me."* but when they found something interesting in the biography, they stated: *"... Well, those two things are interesting."*. However, P10 was more interested in the extra information displayed under the tabs, stating: *"... so relevant work, publications, projects and videos is quite useful"*. P11 also shared similar discomfort with the biography stating that: *"There is a lot of text that is similar... Breaking that up would be nice."*. Additionally, P11 was more interested in the relevant work as well, stating, *"The relevant work is so interesting and could be very important to make a decision..."*. P9 was more optimistic about the information stating:

> *"I think working with this individual would be very beneficial, because of the individual's background, it seems very strong ..."*

Text Quality: During the Think-Aloud sessions, participants provided their remarks over the three generated biographies. Table 5.x includes excerpts for the default, general, and knowledgeable biographies, and the difference between them. The default version was preferred by six participants with P4 stating:

> *"looks nice and short on first inspection. It's written in plain English, there are no acronyms. It's not too technical. "*

while P3 praised its concision stating: *"It's quite concise."* However, three participants though it was lengthy with P2 and P10 thinking it should be broken down into bullet points: *"split it into bullet points..."*. The general audience biography was considered wordy with P1 commenting: *"It's quite wordy... It's got nice language, but it kind of uses extra words for the sake of it"* and P3 agreeing with this view stating: "It's a bit waffly waffly and doesn't actually give us any substance." The knowledgeable

biography was not received with much enthusiasm either, with remarks such as: *"It's still as light touch in terms of the technical aspects of it'"*, *"If I was a scientist, I think I'd be looking for more"* (P3) and *"I don't know that you would necessarily need more knowledge to read this one."* (P6). With remarks such as: *"I can't really understand the difference between the original and the general audience."* (P5), the difference in technicality between the general and knowledgeable versions was not distinct enough. P3 commented that the knowledgeable one is good to be generated for the standard profile remarking: *"... but if I was to choose something that would sit in his profile box, I would probably go for the knowledgeable audience one because it's not that technical that other general audiences wouldn't understand"*

In general, all participants thought that all biographies are clear and did not contain any complex words. However, there is a variation on the concision of biographies. Some participants thought the default version was of appropriate length while others perceived it as being long and that it needs to be broken down or summarised further. On being tailored to a specific audience, participants did not think there is much of a difference between the knowledgeable and the other overviews, The 'knowledgeable' biography is not perceived as too technical, with some participants expecting the knowledgeable one to contain more jargon. Feedback from the participants suggest that there is no need for the general audience biography and that the knowledgeable version could benefit from additional details, particularly around research and publications.

Table 5.3: Breakdown of information accuracy based on the academics the BDEs search for during the Think-Aloud sessions (✓=Accurate, X= Wrong

#	Academic	Image	Homepage	LinkedIn	Twitter	Overview	Research Themes	Publications
1	M. B.	✓	✓	✓	✓	✓	✓	✓
2	M. R.	✓	✓	✓	✓	✓	✓	✓
3	S. S.	✓	✓	✓	X	✓	X	X
4	I. M.	X	✓	X	✓	Unverifiable info.	✓	✓
5	O. M.	✓	✓	✓	✓	✓	✓	✓
6	N. G.	✓	✓	✓	✓	Wrong name.	✓	✓
7	D. A.	✓	✓	✓	Wrong	✓	✓	✓
8	L. B.	✓	✓	X	✓	Unverifiable info	✓	✓
9	J. C.	✓	X	✓	✓	✓	X	X
10	E. L.	✓	✓	✓	✓	✓	✓	✓
11	G. L.	✓	X	X	X	X	✓	✓
12	K. E.	✓	✓	✓	X	✓	✓	✓
13	M. L.	✓	✓	✓	X	✓	✓	✓
14	B. R.	✓	✓	✓	✓	✓	✓	✓
15	P. B.	✓	Broken	✓	X	✓	X	X
✓Total		14	12	12	9	11	12	12

Chapter 6

Conclusions

6.1 Answers to Research Questions

- RQ1: What comprises a compelling academic profile according to the BDEs? To answer this question, a pre-design study was conducted to address the two sub-questions.

- RQ1.1: What challenges do the BDEs face in identifying and evaluating academics and sharing their information with their customers?

  The primary challenges the BDEs face when assessing academics for potential collaborations include the lack of sufficient information about the academic in the existing profiles, outdated information, inconsistency in profiles, inefficiency in information management, and maintaining and disseminating information about academics. RQ1.2: What are the solutions

- RQ1.2: What are the solutions to facilitate the presentation of academic profiles that tailor to the needs of the BDEs and their clients?

  The solution to overcoming the challenges requires a balance between automation and human intervention. While the automation aspect can improve productivity for BDEs in updating and managing academic details, the differences in users' perception of imortant information shows that the BDE is the one who ultimately makes the decision on what to include or exclude, according to their knowledge of the client.

  In conclusion, what makes a good academic profile according to BDEs is highly dependent on their clients' preferences, although some information can be consid-

ered more important and must be included in the profile such as the name, image, affiliations, position, job title, research themes and a sample of representative projects and publications.

- RQ2: How can a tool be designed to generate profiles tailored to the BDEs needs? To answer this question and its sub-questions, a combination of early users' involvement in the form of the pre-design study as well as iterative design process in the form of formative and summative evaluations was employed.
  - RQ2.1: What are the tools' requirements to effectively generate profiles? As inferred from the the pre-design, formative and summative evaluation studies, the tool needs to incorporate the following requirements:
    * Customisable profile options for the BDEs to tailor content for their clients.
    * Profiles structured like a CV for professional representation.
    * Expertise presented as tags/metatags for clarity and brevity.
    * Tabbed menu format for publications and projects.
    * A mechanism for non-intrusive profile verification with the academic.
    * Concise and clear biography detailing academic backgrounds tailored to the audience.
    * Profiles structured like a CV for professional representation.
    * Options for other types of information such as videos should be included.
    * A track record of who created a profile and a timestamp should be employed for accountability
  - RQ2.2: How to best personalise the profile generation process to meet various users' needs and preferences? To achieve personalisation based on users' needs, it was concluded that users should be given the choice on how they construct the profile whether in an additive approach for those who prefer more customization or a subtractive approach for those who might prioritize time and standardization. In conclusion, The tool was built t accommodate both approaches to better serve the preferences of the users and fulfil their requirements.
- RQ3: To what extent can the new tool generate profiles that tailor to the needs of the BDEs?

- RQ3.1: How useful is the tool for the BDEs? Overall, the tool was well-received by users. The tool's features, from the standard profile and building the profile step by step to the sharing mechanisms serve the primary needs of the users. With an 'excellent' usability score and positive feedback on layout and functionality, the tool effectively addresses BDEs' needs, though some refinements are suggested.
- RQ3.2: How accurate and relevant are the profiles generated by the tool?

  When evaluating the overall accuracy rate of the profiles, the tool achieved an approximate accuracy of 78%. With potential improvements, as in allowing users to manually choose the correct Google Scholar profile, the accuracy rate could increase. Despite the inaccuracies, some participants expressed that it is not problematic because they can fix the problem by editing the content. In terms of relevancy, BDEs generally perceived the profiles as relevant. They mostly appreciated the default biography thinking it gave a comprehensive sense of the academic's work. For External Partners, their feedback on relevance was mixed. While some details in the biography were seen as redundant or irrelevant, sections like relevant work, publications, and videos were appreciated more than the overview which was a lot of text for them.
- RQ3.3: How do BDEs and external partners perceive the quality of the generated biographies?

  During Think-Aloud sessions, BDEs evaluated three versions of biographies generated by the tool: default, general, and knowledgeable while external partners evaluated the default one only. For BDEs, the default biography was preferred for its clarity and brevity, while the general one was perceived as being verbose. The knowledgeable biography was not perceived as technical enough for participants. All versions were clear without complex jargon, but feedback highlighted a need for more tailoring by eliminating the general version and refining the knowledgeable one to truly speak to a more experienced audience.

  In conclusion, the tool showed promising performance and potential for improvement. Further investigation needs to be carried out to draw more conclusions on the accuracy and relevancy of the information and the knowledgeable biography need to include the research input for more technical

content.

6.1.1 Limitations and Recommendations for Future Work

There are a few limitations that needs to be addressed in the future to ensure the tool can be deployed. First, the evaluation of the tool's ability to produce accurate and relevant profiles was conducted on a small scale because of time and budget constraints. Accordingly, the findings may not be representative. Given the small sample size of the current evaluation, further evaluation with BDEs and external partners with more profiles and different versions of the biography for the same academic is required to draw more concrete evidence of the accuracy and relevancy of the presented information. Moreover, involving academics in the evaluation can provide richer feedback and a more holistic understanding of the tool's performance. Second, the knowledgeable audience biography relied on the same data source as the default and general one but with a different prompt. In the future, it is more beneficial to include the research papers in the context to allow the model to generate a biography with more technical content that speaks to a knowledgeable audience. Finally, a notable source of error within the tool was its dependency on Google Scholar for data extraction using the academic's name and the phrase "University of Edinburgh". This is especially problematic in cases where multiple academics shared identical or similar names. Employing a mechanism for name disambiguation or relying on digital identifiers such as ORCID may yield better results.

6.1.2 Conclusion

This project investigated developing a tool to generate academic profiles from multiple sources to tailor to the needs of BDEs and their external partner. a UCD approach was utilized during the lifecycle of the project, emphasizing users' needs, preferences, and challenges throughout the design process. The methodology was divided into three stages: the pre-design, formative evaluation, and summative evaluation stages. The studies aimed to identify the challenges the BDEs encounter with the current tools, the requirements for the tool and the best way to personalise the experience of building profiles to users. The project also investigated incorporating GPT-3.5 to generate the biographies automatically and aimed to assess the quality of the generated text using BDEs as human evaluators to judge its clarity, concision, and suitability for audiences with different knowledge base. The results show that the main challenges

with the existing tools include the lack of sufficient information on one single profile, the presence of outdated information, the inconsistency in the structure and presentation of the profiles and the lack of a mechanism for maintaining and disseminating the information across BDEs. As revealed by the semi-structured interviews, opinions of BDEs about what information to include in the profile vary. Accordingly, the tool has to allow users to curate the profiles according to their perceptions of what their clients may need to make the decision about the collaboration opportunity. Running informative evaluation to inform the design of the tool's UI showed that users also differ on the way they prefer for building the profile with some users preferring to see the whole picture first while others prefer to build the profile step by step. By running a summative evaluation study to assess the usefulness of the tool and its effectiveness in generating accurate and relevant profiles, the findings showed an acceptable level of accuracy. The relevancy aspect was assessed in Think-Aloud sessions with BDEs and external partners which revealed that BDEs thought the standard information was relevant while the external partners were less interested in the overview and more interested in the relevant work. As for the quality of the text of the generated biography by the language model, BDEs expressed a level of satisfaction with the default biography while the general one was assumed to be unnecessary. Although the knowledgeable audience biography did not provide much technical content, the BDEs encouraged keeping it but changing the context to involve research papers. The findings of the summative evaluation suggest the tool is perceived as useful by BDEs with an excellent SUS score and overall satisfaction with the feature provided.

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Appendix A

Participants' information sheets

Participant Information Sheet

Project title:	A User-Centric Tool for Generating Academic Profiles using a Pre-Trained Large Language Model
Principal investigator:	Aurora Constantin
Researcher collecting data:	Safa Alsalman
Funder (if applicable):	

This study was certified according to the Informatics Research Ethics Process, reference number 7569. Please take time to read the following information carefully. You should keep this page for your records.

Who are the researchers?

The study is conducted as part of a research for a Master's project at the University of Edinburgh. The collected data will be used primarily by Safa Alsalman, a student at the School of Informatics under the supervision of Aurora Constantin from the School of Informatics, as well as Charlotta Cederqvist and Emily Lekkas From the Bayes Centre.

What is the purpose of the study?

The aim of the project is to improve the quality and consistency of academic profiles to meet the needs of Bayes Centre staff and external partners by creating a tool for the automatic generation of academic profiles. This study aims to:

- Identify challenges faced by the staff and external partners when it comes to finding appropriate academics to collaborate with.
- Collect user requirements for the design and development of the tool.

Why have I been asked to take part?

You have been invited to participate in the study because you volunteered to contribute to interviews and because you are part of the target audience who will use the tool. The target audience of the tool include staff at the Bayes Centre who will

use the tool to generate the profiles as well as business partners who will receive the constructed profiles.

Do I have to take part?

No – participation in this study is entirely up to you. You can withdraw from the study at any time, up until August 10, 2023, without giving a reason. After this point, personal data will be deleted and anonymised data will be combined such that it is impossible to remove individual information from the analysis. Your rights will not be affected. If you wish to withdraw, contact the PI. We will keep copies of your original consent, and of your withdrawal request.

What will happen if I decide to take part?

You will participate in at least one semi-structured interview and may also be invited to participate in a follow-up interview. During the interview, you will be asked a combination of closed and open-ended questions. Accordingly, the nature of questions may change to adapt to your responses. The time estimated for the interview is between 30 and 60 minutes. Interviews may be online or in-person, according to your preference and availability. If the interview is conducted in person, only audio will be recorded. If online, the interview will be recorded in a video format[1]. Interviews will be transcribed to facilitate data anonymisation and analysis. You may be invited to participate in later evaluation studies when the tool is ready for testing.

Are there any risks associated with taking part?

There are no significant risks associated with participation.

Are there any benefits associated with taking part?

No.

What will happen to the results of this study?

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will be anonymized: We will remove any information that could, in our assessment, allow anyone to identify you. With your consent, information can also be used for future research. Your data may be

[1] Note that it is up to you to decide if you want to use the camera during the recording or not.

archived for a maximum of 4 years. All potentially identifiable data will be deleted within this timeframe if it has not already been deleted as part of anonymization.

Data protection and confidentiality.

Your data will be processed in accordance with Data Protection Law. All information collected about you will be kept strictly confidential. Your data will be referred to by a unique participant identifier rather than by name. Your data will only be viewed by the researcher/research team: Safa Alsalman, Aurora Constantin, Charlotta Cederqvist and Emily Lekkas.

All electronic data will be stored on a password-protected encrypted computer, on the School of Informatics' secure file servers, or on the University's secure encrypted cloud storage services (DataShare, ownCloud, or Sharepoint) and all paper records will be stored in a locked filing cabinet in the PI's office. Your consent information will be kept separately from your responses in order to minimise risk.

What are my data protection rights?

The University of Edinburgh is a Data Controller for the information you provide. You have the right to access information held about you. Your right of access can be exercised in accordance Data Protection Law. You also have other rights including rights of correction, erasure and objection. For more details, including the right to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk. Questions, comments and requests about your personal data can also be sent to the University Data Protection Officer at dpo@ed.ac.uk.

Who can I contact?

If you have any further questions about the study, please contact the lead researcher, [Safa Alsalman, s2094463@ed.ac.uk].

If you wish to make a complaint about the study, please contact inf-ethics@inf.ed.ac.uk. When you contact us, please provide the study title and detail the nature of your complaint.

Updated information.

If the research project changes in any way, an updated Participant Information Sheet will be made available on http://web.inf.ed.ac.uk/infweb/research/study-updates.

Alternative formats.

To request this document in an alternative format, such as large print or on coloured paper, please contact: Safa Alsalman s2094463@ed.ac.uk.

General information.

For general information about how we use your data, go to: edin.ac/privacy-research

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What is the purpose of the study?

The aim of the project is to improve the quality and consistency of academic profiles to meet the needs of Bayes Centre staff and external partners by creating a tool for generating academic profiles automatically. This study aims to collect user feedback on the design of the tool and identify strengths and weaknesses of the design before advancing to the implementation stage.

Why have I been asked to take part?

You have been invited to participate in the study because you volunteered to contribute to interviews and because you are part of the target audience who will use the tool. The target audience of the tool are staff at the Bayes Centre who will use the tool to generate the profiles as well as business partners who will receive the constructed profiles.

Do I have to take part?

No – participation in this study is entirely up to you. You can withdraw from the study at any time, up until August 10, 2023, without giving a reason. After this point, personal data will be deleted and anonymised data will be combined such that it is impossible to remove individual information from the analysis. Your rights will not be affected. If you wish to withdraw, contact the PI. We will keep copies of your original consent, and of your withdrawal request.

What will happen if I decide to take part?

You will participate in evaluating the proposed prototype. During the evaluation session, you will be asked to freely explore the prototype and then to perform specific tasks. Think Aloud protocol will be employed, which requires you to verbalise your thoughts while exploring the prototype. You may be asked to take part in a short interview to clarify some aspects related to your experience with the prototype. The time estimated for the session is about 90 minute. The sessions may be online or in-person, according to your preference and availability. We will record the session using software to capture audio, video and computer screen for further data analysis. You may be invited to participate in later evaluation studies when the tool is ready for testing.

Are there any risks associated with taking part?

There are no significant risks associated with participation.

Are there any benefits associated with taking part?

No.

What will happen to the results of this study?

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will be anonymized: We will remove any information that could, in our assessment, allow anyone to identify you. With your consent, information can also be used for future research. Your data may be archived for a maximum of 4 years. All potentially identifiable data will be deleted within this timeframe if it has not already been deleted as part of anonymization.

Data protection and confidentiality.

Your data will be processed in accordance with Data Protection Law. All information collected about you will be kept strictly confidential. Your data will be referred to by a unique participant identifier rather than by name. Your data will only be viewed by the researcher/research team: Safa Alsalman, Aurora Constantin, Charlotta Cederqvist and Emily Lekkas.

All electronic data will be stored on a password-protected encrypted computer, on the School of Informatics' secure file servers, or on the University's secure encrypted cloud storage services (DataShare, ownCloud, or Sharepoint) and all paper records will be stored in a locked filing cabinet in the PI's office. Your consent information will be kept separately from your responses in order to minimise risk.

What are my data protection rights?

The University of Edinburgh is a Data Controller for the information you provide. You have the right to access information held about you. Your right of access can be exercised in accordance Data Protection Law. You also have other rights including rights of correction, erasure and objection. For more details, including the right to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk. Questions, comments and requests about your personal data can also be sent to the University Data Protection Officer at dpo@ed.ac.uk.

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What is the purpose of the study?

The aim of the project is to improve the quality and consistency of academic profiles to meet the needs of Bayes Centre staff and external partners by creating a tool for generating academic profiles automatically. This study aims to evaluate a tool and identify the strengths and weaknesses of the implemented design and evaluate the quality and accuracy of the generated text.

Why have I been asked to take part?

You have been invited to participate in the study because you volunteered to contribute to interviews and because you are part of the target audience who will use the tool. The target audience of the tool are staff at the Bayes Centre who will use the tool to generate the profiles as well as business partners who will receive the constructed profiles.

Do I have to take part?

No – participation in this study is entirely up to you. You can withdraw from the study at any time, up until August 10, 2023, without giving a reason. After this point, personal data will be deleted and anonymised data will be combined such that it is impossible to remove individual information from the analysis. Your rights will not be affected. If you wish to withdraw, contact the PI. We will keep copies of your original consent, and of your withdrawal request.

What will happen if I decide to take part?

You will participate in a usability evaluation. During the evaluation session, you will be asked to freely explore our tool and then to perform specific tasks. Think Aloud protocol will be employed, which requires you to verbalise your thoughts while exploring the tool. Then you will be invited to fill a questionnaire, with a combination of closed and open-ended questions to collect your feedback over the individual tasks and the overall experience and you will also be asked to evaluate the quality of the generated text in terms of accuracy, coherency, and relevancy. You may be asked to take part in a short interview to clarify some aspects related to your experience with the tool. The time estimated for the session is about 90 minute. The sessions may be online or in-person, according to your preference and availability. We will record the session using software to capture audio, video and computer screen for further data analysis.

Are there any risks associated with taking part?

There are no significant risks associated with participation.

Are there any benefits associated with taking part?

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What will happen to the results of this study?

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will be anonymized: We will remove any information that could, in our assessment, allow anyone to identify you. With your consent, information can also be used for future research. Your data may be

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Appendix B

Participants' consent form

Participant number:_____

Participant Consent Form

Project title:	A User-Centric Tool for Generating Academic Profiles using a Pre-Trained Large Language Model
Principal investigator (PI):	Aurora Constantin
Researcher:	Safa Alsalman
PI contact details:	

By participating in the study you agree that:

- I have read and understood the Participant Information Sheet for the above study, that I have had the opportunity to ask questions, and that any questions I had were answered to my satisfaction.
- My participation is voluntary, and that I can withdraw at any time without giving a reason. Withdrawing will not affect any of my rights.
- I consent to my anonymised data being used in academic publications and presentations.
- I understand that my anonymised data will be stored for the duration outlined in the Participant Information Sheet.

Please tick yes or no for each of these statements.

1.	I agree to being audio recorded.	☐ **Yes**	☐ **No**
2.	I agree to being video recorded.	☐ **Yes**	☐ **No**
3.	I allow my data to be used in future ethically approved research.	☐ **Yes**	☐ **No**
4.	I agree to take part in this study.	☐ **Yes**	☐ **No**

Name of person giving consent	Date dd/mm/yy	Signature

Name of person taking consent	Date dd/mm/yy	Signature

THE UNIVERSITY of EDINBURGH informatics

Participant number:_____

THE UNIVERSITY of EDINBURGH
informatics

Appendix C

Pre-design Study Resources

C.1 Interview Questions and Script

Questions: 1. Tell me about your role and responsibilities within Bayes Centre? Follow-up: 1.1 What was the last request you received? How did you handle it? 1.2 How would you handle the situation if you get a similar request again?

2. What are your goals or objectives when searching for the academic? 2.1 How do you measure success or effectiveness in this task? 2.2 Are there other people involved in the workflow? Who are they?

3. How do you currently access or obtain the required information to find academics? 3.1 Tell me about the tools or technologies you currently use. 3.2 Tell me about the features you like in these tools. Why you like [a certain feature]? 3.3 Tell me about pain points do you currently face when using these tools. 3.4 Why do you find [a certain feature] annoying? 3.5 How did you handle the situation when the information is not available or not directly usable? 3.6 How do you communicate the results to others?

4. What information do you expect or need to be present in a profile to determine if the academic is suitable for the project's needs?

5. In the next slide, you will see different types of information. Can you rank these based on their importance? As you rank them, please comment on whether you think the information is important or not and why?

Name, Image, Job title, Contact Info (Phone, email, office), Affiliation, position, Social media accounts, Education/Qualifications, Past career, Research Interests, Projects, h-index, citations, most cited work, Most recent work

6. What constitute a good biography in your opinion? 6.1 Which presentation style do you prefer for presenting information? Free-text, structured information,

visualizations or a mixture of multiple styles. 6.2 How long, in words, do you think an effective biography should be?

Script Hello. Thank you for attending the interview. My name is Safa Alsalman and I am an MSc student in the School of the Informatics. Today, I will interview you about your experience with looking for collaborators for business partners. Before we start, I want to remind you about a few things: The consent form and participant information sheet have been sent to your email along with the invitation to the meeting. The interview will take between for 30 to 40 minutes and will be video recorded. You do not need to enter any personal information. Your participation today is voluntary, and you may stop at any time and leave the interview if you wish to. The interview will start by asking you about your role and workflow and will move on to ask about your opinion on what makes a good profile and biography. Please remember that the goal of the interview is to take your input and understand your perspective to help us improve the quality and consistency of academic profiles by creating a tool for the automatic generation of the profiles. Do you have any questions before we start?

C.2 Detailed Results

Theme	Relevant Codes	Quotes	Participant
Challenge	insufficient information	There's some really bad ones someone should definitely do a formal training on how to do a profile because some don't have anything, any detail at all	P4
		…how people find you to collaborate, because you don't present what you do.	P4
	out of date information	[Social media] 'The problem with that one, because if people don't use them or they use them very irregularly and they're poorly managed, then actually it can be detrimental'	P5
		people usually only want references from the last 3 years, so once it's passed three years, maybe five, it's tends to be a bit obsolete in many areas.	P4
		[Research explorer] I haven't had a need recently, and when I have used it in the past I found it and it still had people on the system that have left the university.	P3
		People don't keep their web pages up to date in the university and they don't necessarily have a profile within the university.	P3
		… but they're not always up to date either on the universe, even on the LinkedIn, or even on the university research pages.	P1
	inconsistency	'quality and consistency is an issue in people's profiles.	P5
	multiple sources of information	I've used PubMed which is obviously you know the NCBI free Open Access.	P2
	usability problem	We have an IRM which says about all the collaborations that people are doing with external partners and whether it be contract research consultancies, startups.	P4
		I think probably part of the problem we have at the moment is the tools that we have are not very quick and easy to use.	P1
		But it's a question of whether, whether that process could be more efficient, if there was a way automating that.	P5

	maintaining, disseminating information	I'd really like us to improve the way we curate information about our academic capability, how we maintain that and how we disseminate that both internally and externally.	P5
Need	executive summary style	2 or 3 paragraphs, top level outline, like an abstract or an executive summary.	P2
	customizable	I would usually refer back to the academic to ask them to either write something if it's needing to be very tailored to the problem, and I don't feel I've got adequate knowledge to be able to do that, I would ask them to write that themselves, or I'd ask them to check what I'd written.	P5
	CV structure	It's the more or less standard requirement to provide short biographies and sometimes even CVs for people which again have to be tailored. I would have that alongside cause essentially it's like a mini CV.	P5
	List of Themes	I think it's people who are able to describe their research areas as well and not just have as one word.	P4
		I also think there should be hashtag word like metatags identifying specific research interests in detail.	P3
		Then, bullet points underneath of other areas or research avenues you're interested in.	P2
		Metatags on non-technical way of framing and I think it needs to be obviously reflective of that person specific interest	P5
	tabs	… They have the profile with the links to the projects and then they have a second tab which is the publications and you can then flip between them.	P4
	verification	If there is a database that I could draw from. I wouldn't have to go to somebody and ask them for have anything changed in your biography since the last time I spoke to you 12 months ago?	P5
Data source	Google	I use Google a lot. It's free. Google is very, very powerful.	P2
		… then do Google search just to understand what their background, what they may be interested in research wise	P1

		I Google it. I literally put it in a Google engine and see if I can find academic at the university of Edinburgh that falls in Google.	P3
	LinkedIn	I would look them up on LinkedIn	P1
	PubMed	It's certainly something that Edinburgh innovations, the communications and marketing team have seen value in and so they have invested in is LinkedIn training for the team.	P5
		I don't think LinkedIn is a particularly well-use platform by many academics.	P3
		I've used PubMed, the NCBI free Open Access. … So, if it was an academic I was looking for, I'd probably start there.	P2
	Research Explorer	I think project page is probably the most useful from our point of view when it comes to and making sure that the academic has some experience in terms of applying their research onto actual problems.	P6
		I think the quality of the information could be much improved.	P5
		but often it's a new topic. And so yeah, tools like opportunity match and Research Explorer really helpful.	P4
		when I have used it in the past I found it and it still had people on the system that have left the university.	P3
		I have used it, I've just not used it in the last three to six months, though it is. It is very good, I know.	P2
		I don't even know what it is.	P1
	OpportunityMatch	… you might want to say, oh, I need somebody who can talk about climate, and then you'd look on OpportunityMatch, then you'd see all the people have done research or may have done a project …	P4
	IRM	We have an IRM which says about all the collaborations that people are doing with external partners and whether it be contract, research consultancies, startups.	P4

	school pages	the IRM, something that the university is committed to and rolling out across all of its activities, partnership activities, but there are still clusters that aren't using the IRM, they're not trained on it, haven't registered on it. There's also a group of people that are, but they use it very infrequently and all the data that they're putting in is not particularly detailed because they can't necessarily see the value of doing so.	P5
		But we have the IRM which is a system which records how will our projects are and all our contact details should be in there, but again I'm not brilliant at it, a weakness of mine recording all that information in the system.	P1
		Then, if it's a project within a school, quite often there might be details of it.	P6
		So, and I primarily went to university web pages for that.	P2
		People don't keep their web pages up to date in the university and they don't necessarily have a profile within the university.	P3
	word of mouth	I emailed my colleague… because this is where I would think that this sort of expertise would sit.	P6
		I trust certain people ... and if they say this is a great person that that then you can just trust them and you will then follow up with them directly. But it takes time to build up that trust, so there's many new people who, you know, for them, having a tool would be better.	P4
		We're far more likely to reach out to each other for to ask for help, or a favor for a particular project.	P2
		I guess and a lot of it has been worded mouth	P1
		just contacting the people who are the experts in that area… I would use old fashioned knowledge of people.	P3
		I will try to speak with colleagues through word of mouth to know who's there and who's doing what. But it's a very manual process, very time consuming.	P5

Profile Information	name	you obviously need name, job title at the top.	P6
		Obviously the name I think it's most important and then affiliation	P4
		name, name, image and job title are absolutely the top ones.	P2
		Name and research interests, and then probably contact information, those are the three most important.	P1
		I think name and contact information are essential pieces of information up front.	P5
		I think obviously the name	P3
	image	… and the image is. I think it's relatively important. I think it's important not as much because you want to see if it's male or female or younger or old. I think it's just because people work with people.	P3
		you obviously need name, job title at the top.	P6
		A picture of the researcher of he or she absolutely to make it a human.	P2
		Image is less important to me personally. I mean, it's helpful if you're mixing with 100s of colleagues …, or you're expecting to meet someone in person,…, if you bumped into them that you'd be able to pick them out.	P5
		I don't really take notice of it, so for me it doesn't have any bearing on whether I say that Think I'll choose them or not.	P4
	job title	you obviously need name, job title at the top.	P6
		job title with affiliation	P4
		name, image and job title are absolutely the top ones.	P2
		I'm not interested in what they're title is.	P1
		I mean usually they've got in their title. It's more for background information	P5
		I don't think job titles are massively important myself, but that's just a probably a personal choice.	P3

	Contact information	I think contact info should be there and I wouldn't. I don't see as at risk anyway.	P6
		Ultimately the business development people are there to facilitate introductions and kind of project management to some extent. You want to be a help and not a hindrance and I don't see that as an issue.I don't think that I think contact info should be there and I don't see as at risk anyway.	P6
		I mean email address is definitely the most vital thing, and then then contact information and social media accounts in the bottom.	P2
		Name and research interests, and then probably contact information though those are the three most important. The rest is then secondary.	P1
		I think name and contact information are essential pieces of information up front, simply so that you've got a unique identifier for somebody and a means of reaching them should you wish to.	P5
		Contact information I think is interesting that one because it depends how this profile is being used, because I would have thought the business development people won't want to lose the relationship. I don't think you're gonna avoid getting the contact information, but I wouldn't put it up the top. In other words, if you want to see whether you want to engage with somebody, you want to see if you want to engage with them before you contact them, so the contact information you're gonna ignore it right at the beginning, cause you've not read whether you want to work with them yet or not. Only when you've decided this is something that might be able to help you, might you go ohh, I'll reach out to them, but I want to question the reaching out process of whether that is intended that these will be documented for a company to contact the academic directly or to contact the business development person.	P3
	affiliation	I mean, obviously contact info, but then you have the email account or outlook you can just type in the name and add their email.	P4

		your affiliation with your school and your position I would probably see that as being the next level.	P6
	position	affiliation position next, but I would tie that into the first piece of information.	P2
		[affiliation] position and affiliation, the position and then affiliation with the school or an institute or a hub is helpful to me. I know where to place them in the organization.	P5

		Obviously the name I think it's most important and then affiliation	P4
		I'm not interested in what position they've got. I would say increasingly interested parties aren't bothered by how senior the people are.	P1
	social media accounts	They might know and it's useful by way of background to an external globalization.	P5
		After that, affiliation and position but I would tie that into the first piece of information.	P2
		affiliation with school and position, I would probably see that as being the next level.	P6
		I think you know, I wouldn't necessarily go on to like social media to look at them straight away, but I think it can be useful to see that they have it.	P6
	education	Many puts it below contact information directly under. So a LinkedIn profile or Twitter or whatever they might be on.	P5
		There's a problem with that one, because if people don't use them or they use them very irregularly and they're poorly managed, then actually it can be detrimental.	P5
		It's good to have them absolutely, but if you're just looking to understand what an individual does, they don't need to be first and foremost.	P2
		Education/qualifications and past career, would put them on us the same level	P6
		career and education qualifications. And I would keep that brief	P2
		If they're working for the university, they're qualified enough.	P1
		it's more for background information, I would say.	P5
		so if you're gonna have a education/qualification and past career, have it down the bottom somewhere.	P5
		I don't necessarily think educational qualifications is important.	P3

	past career	[important] projects and past career	P4
		I don't have particularly strong feelings about it. Some people from a kind of chronological point of view might see that as coming before research or projects.	P6
		career and education qualifications. And I would keep that brief	P2
		in my bio I just I put a bit about my history, my job history because I think it is relevant.	P1
		I think that only becomes interesting if, if they've sat on project boards or they've done something in industry previously that's of value. It shows that in addition to their current academic career, that they have some applied experience which might be of interest. But again, that's less than some of the more recent stuff that they would be doing.	P5
		I don't think they're gonna care too much about their past career.	P3
	research interests	So, you're saying, what, what does this person do? And here are some illustrative examples. So that's I would have those two things working in tandem.	P5
		I think it's what's really important is their research interests. You need a very quick way of what that academics main research objectives are…	P3
		Then, bullet points underneath of other areas or research avenues you're interested in.	P2
		It's more about what is the relevant research they are doing or have done to the project that companies interested in.	P1
		Research interests. So what they experts in.	P4
		research interest actually should go higher up, because it will help and maybe you would put research interests ahead of projects.	P6
	projects	I think as of mentioned before, project is an important part.	P6
		hyperlinks to all the projects that they've worked on.	P4
		I prefer projects in case of these two to research papers.	P3

		And then in terms of the next most important, I would say: research interests and projects.	P2
		I guess the next level of what would be important is projects and recent work. It's more about what is the relevant research they are doing or have done to the project that companies interested in.	P1
		They might have done a really interesting collaborative project with X company.	P5
	h-index	I guess the fact that didn't I couldn't remember what H- index is, tells you about the fact that, people might not know what that is.	P6
		'a quantitative measure like that is only as useful as much as it's known.'	P2
		The reason that I'm knocking the h-index so little bit saying the companies won't care … [academics] probably not very high in high in the H-index, but that doesn't mean to say that the company can't get the skills and expertise that it wants from the academic.	P3
		'I don't know what an h-index is.'	
		'That's not what company is looking for.'	
		'I don't even know what h-index is'	P4
		Looking at the bottom, h- index, citations, most cited work.	P5
	citations	Looking at the bottom, h-index, citations, and most cited work.	P5
		citation is obviously the kind of an academic institution metric… but I guess companies may be impressed with that sort of thing	P6
		Citations is about academic expertise. It's because a company wants to make sure that they can work the research in that on applied sense, they need to apply it into the commercial entity.	P3
		citations. The most recent work I'd kind of put them in the same area.	P2
	most cited work		

	most recent work	I would probably put most recent work above.	P6
		I always think is really helpful and it mentions the current research projects.	P4
		Citations, the most recent work I'd kind of put them in the same area.	P2
		I guess the rest the next level of what would be important to our projects and recent work.	P1
		The company is interested in the now, but that academic might have done that research work five years ago.	P3
		So, you're saying, what, what does this person do? And here are some illustrative examples. So that's, I would have those two things working in tandem.	P5
Biography	clear	It needs to be clear and concise	P5
		think you need a very brief paragraph about their expertise in layman's term, not overly scientific.	P3
		I guess you imagine the audience for a profile, it could be a policymaker, could be an industrial partner, it could be another collaborator from other academic institution, it could be a student who wants to look at, think who would I like to be my supervisor. So the clearer the language and the more information you can provide that's suitable for any audience, the better.	P4
		The broader point is it has to be concise and clear.	P2
	concise	It needs to be clear and concise	P5
		The broader point is it has to be concise and clear. So I'd say no more than sort of two or three paragraphs because, people are busy and they don't want to read an essay.	P2
		you need a very brief paragraph about their expertise	P3

		If you do the profile, people don't want to get too much detailed through quickly, so they want a very high level paragraph. A paragraph and then… narrowing down a little bit to specific expertise and then if you want to see the detail about expertise, that's where you'll look at case studies and papers.	P3
	Technical/academic	I think that there's a balance here. Of course some areas are very technical and so they might not be an easy way to describe what you do without make you know it being quite difficult for outside people to understand.	P6
		If you're an academic talking to somebody who works for a science company, they're likely to have a science degree or a PhD or some kind of technical background. So, I think the most productive meetings are the ones where the two participants are speaking the same language… I mean, scientific language straight off the bat as soon as possible. I think that shows trust that you know not dealing with somebody who's wasting their time.	P2
		I think if it's too academic and tone then it may be put off external collaborators potentially cause they'd think, well, maybe they don't know how to work outside of the academic sphere.	P4
	layman terms	think you need a very brief paragraph about their expertise in layman's term, not overly scientific.	P3
		If you're reaching out to a company that you know has expertise in a particular field, you know these people probably aren't stupid. So, putting it in layman's terms, you know simple terms isn't the best. You want to make sure it's at a technical level that they understand quickly and be, oh, OK, these guys work on that.	P2
	plain English	and use plain English, so I would very much avoid using acronyms any technical terms or if there are technical terms to add a brief explainer.	P5

Appendix D

Low-fidelity Prototype and Formative Evaluation

D.1 Script

Before we start, I would like to remind you about a few things:

1. The session will take up to 30 minutes.
2. We will record the session.
3. Your participation is voluntary, and you may stop at any time if you want to.

Any questions before we start?

"In this session, we are interested in what you think about as you perform the tasks we are asking you to do. In order to do this, I am going to ask you to talk aloud as you work on the task. What I mean by "talk aloud" is that I want you to tell me everything you are thinking from the first time you see the statement of the task until you finish the task. I would like you to talk aloud constantly from the beginning of the task until the end. I don't want you to try to plan out what you say. Just act as if you were alone, speaking to yourself. Remember that we are testing the product not you, so each of your observations, however trivial you may think, is important for us. So, it is most important that you keep talking. If you are silent for any long period of time, I will ask you to talk. Do you understand what I want you to do?

We have conducted a series of interviews to find out what kind of profiles a BD may want to share with external partners, and based on insights from potential users, we have designed 2 prototypes for a profile generation tool.

I will share the link of the first prototype is in the chat box now. Please open it and share your screen.

https://balsamiq.cloud/s67lysx/pble13k/r2278?f=N4IgUiBcAMA0IDkpxAYWfAMhkAhHAsjgFo4

Task 1: Generate a profile that contains all the information about Oisin Mac Aodha.

Task 2: Share the profile with Oisin Mac Aodha.

Task 3: Go back to the home screen and search for Oisin Mac Aodha again.

Task 4: Generate a profile that contains the overview, research interests, contact information, papers and projects only.

Task 5: Refine the tone of the Overview by selecting the following options: [Knowledgeable audience and neutral tone].

Task 6: Share the profile with the external partner.

Thank you for completing these tasks. Now, I will send the link of the second prototype.

https://balsamiq.cloud/s67lysx/plppauy/r2278

Task 1: Generate a profile for Oisin Mac Aodha and preview it.

Task 2: Go back to Edit mode.

Task 3: Generate a profile that contains the overview, research interests, and the first 2 projects only.

Task 4: Add the personal website of Oisin Mac Aodha.

Task 5: View the Profile then send it to the external partner.

D.2 Followup Questions:

1. Can you tell me what is the main difference between the 2 prototypes?

2. Which prototype was easier to use in your opinion? And why?

3. What did you find to be difficult to do in the 2 prototypes? And why?

4. What is your overall impression of the layout and order of information in the screens?

5. What aspects of the User Interface you would like to change?

D.3 Breakdown of Tasks Performance

Table D.1: Tasks Performance (Subtractive Approach)

Task	Description	P	Time Spent	Completed Successfully	Success Rate
1	Generate a profile for Oisin Mac Aodha and preview it.	P1	22	No	Generation:
		P2	43	No	
		P3	95	Yes	
		P4	11	No	
		P5	8	No	
		P6	10	Yes	
2	Go back to Edit mode.	P1	5	Yes	100%
		P2	7	Yes	
		P3	9	Yes	
		P4	6	Yes	
		P5	49	Yes	
		P6	2	Yes	
3	Generate a profile that contains the overview, research interests, and the first 2 projects only.	P1	94	Yes	66%
		P2	31	No	
		P3	50	Yes	
		P4	59	No	
		P5	36	Yes	
		P6	13	Yes	
4	Add the personal website of Oisin Mac Aodha	P1	19	Yes	100%
		P2	19	Yes	
		P3	27	Yes	
		P4	50	Yes	
		P5	74	Yes	
		P6	15	Yes	
5	View the Profile then send it to the external partner.	P1	12	Yes	100%
		P2	16	Yes	
		P3	38	Yes	
		P4	11	Yes	
		P5	9	Yes	
		P6	14	Yes	

Table D.2: Tasks Performance (Additive Approach)

Task	Description	P	Time Spent	Completed Successfully?	Success Rate
1	Generate a profile that contains all the information about Oisin Mac Aodha.	P1	14	Yes	100%
		P2	114	Yes	
		P3	50	Yes	
		P4	11	Yes	
		P5	50	Yes	
		P6	30	Yes	
2	Share the profile with Oisin Mac Aodha.	P1	14	Yes	100%
		P2	36	Yes	
		P3	12	Yes	
		P4	7	Yes	
		P5	5	Yes	
		P6	5	Yes	
3	Go back to the home screen and search for Oisin Mac Aodha again.	P1	5	Yes	100%
		P2	25	Yes	
		P3	9	Yes	
		P4	5	Yes	
		P5	2	Yes	
		P6	7	Yes	
4	Generate a profile that contains the overview, research interests, contact information, papers and projects only.	P1	12	No	83%
		P2	7	Yes	
		P3	22	Yes	
		P4	8	Yes	
		P5	10	Yes	
		P6	34	Yes	
5	Refine the tone of the Overview by selecting the following options: [Knowledgeable audience and neutral tone].	P1	25	Yes	100%
		P2	48	Yes	
		P3	22	Yes	
		P4	51	Yes	
		P5	14	Yes	
		P6	16	Yes	
6	Share the profile with the external partner.	P1	5	Yes	100%
		P2	13	Yes	
		P3	40	Yes	
		P4	9	Yes	
		P5	13	Yes	
		P6	6	Yes	

Appendix E

Summative Evaluation Resources:

E.1 Script 1: For BDEs

Before we start, I would like to remind you about a few things:

1. The session may take up to 45 minutes.
2. We will record the session.
3. Your participation is voluntary, and you may stop at any time if you want to. “

We have conducted a series of interviews to find out what kind of profiles a BD may want to share with external partners, and based on insights from potential users, we have developed a tool to automatically generate academic profiles. In this session, we are interested in what you think about as you experiment with the early version. In order to do this, I am going to ask you to talk aloud as you work on the task. What I mean by “talk aloud” is that I want you to tell me everything you are thinking from the first time you open the website until you finish. I would like you to talk aloud constantly. I don’t want you to try to plan out what you say. Just act as if you were alone, speaking to yourself. Remember that we are testing the product not you, so each of your observations, however trivial you may think, is important for us. So, it is most important that you keep talking. If you are silent for any long period of time, I will ask you to talk. Do you understand what I want you to do? Any questions before we start?

E.2 Script 2: For External Partners

We have conducted a series of interviews to find out what kind of profiles a BD may want to share with external partners, and based on insights from potential users, we have developed a tool to automatically generate academic profiles and we need your

assessment on the outcome given a few examples. Before we start, I would like to remind you about a few things:

1. The session may take up to 30 minutes.
2. We will record the session.
3. Your participation is voluntary, and you may stop at any time if you want to. “In this session, we are interested in what you think about as you examine academic profiles for possible collaboration. In order to do this, I am going to ask you to talk aloud as you work on the task. What I mean by “talk aloud” is that I want you to tell me everything you are thinking from the first time you see the profile until you finish. I would like you to talk aloud constantly. I don’t want you to try to plan out what you say. Just act as if you were alone, speaking to yourself. Remember that we are testing the profile not you, so each of your observations, however trivial you may think, is important for us. So, it is most important that you keep talking. If you are silent for any long period of time, I will ask you to talk. Do you understand what I want you to do? Any questions before we start?

E.3 SUS Questionnaire

width=!,height=!,pages=-

E.4 Detailed Results

Table E.1: Text Quality Quotes

Default	It looks nice and short on first inspection like it's written in plain English, there are no acronyms. It's not too technical.	P4
	I quite liked this one because it's short.	P1
	If I was sort of an external company, I think working with this individual would be very beneficial, because of the individual's background... which I think will be very useful in driving my business.	P9
	It is a lot of text. So, if it's split into bullet points, that would be better .	P2
	The overview is a lot of text to have to pass, so if it was possible to summarize it in a way so either by bolding certain concepts or by basically just summarizing this.	P7
	I mean that one is good in that it's quite concise, the original one.	P3
	I quite like brevity.	P8
	I like to be able to and I like bullet points and clear things. That just looks like a lot of texts, and I'm not really excited by reading that.	P10
	I quite like brevity.	P8
general	I like the general audience one in terms of it explains it in really quite clear terms what she does.	P5
	So, depending on who we mean by general audience, when you have general audience, is that really for just lay people, not even industry partnership you want to collaborate with, but just absolutely general public.	
	It's not got anything capable of being too wordy or too academic.	P5
	I wouldn't really say one separates general audience from ones for a knowledgeable audience.	P6
	The general one I would expect any lay person to be able to get a grasp of roughly what he does and what areas he might look at.	P6
	I mean, for me, the only difference between the two is actually the general audience explains concepts, whereas the knowledgeable audience doesn't.	P7
	I mean, it's quite wordy, isn't it? It's got nice language, but then it kind of uses extra words for the sake of it.	P1
	I would say it's a bit waffly waffly and doesn't actually give us any substance.	P3
	I think it's simpler and clearer just to have two, to get rid of the general audience one altogether.	P P3
	You've kind of a bit history of his, and it doesn't assume any prior knowledge.	P8
knowledgeable	Maybe, the knowledgeable one doesn't have to be as succinct as the original text one.	P5
	So, I can see why it included that in the knowledgeable audience and it's a good thing to include.	P5
	I don't know that you would necessarily need more knowledge to read this one.	P6
	I was expecting the knowledgeable one to be a lot more jargon-filled which it isn't really.	P6
	There actually appears to be more interesting or relevant information in the knowledgeable audience.	P7
	You would expect this to have a little bit more around his research and maybe specific areas and pick up on a few of his publications, whereas actually it's still as light touch in terms of the technical aspects of it'	P1
	If I was a scientist, I think I'd be looking for more.	P3
	. . . but if I was to choose something that would sit in his profile box, I would probably go for the knowledgeable audience one because it's not that technical that other general audiences wouldn't understand..	P3
	I think having the knowledgeable audience information to be more detailed, more specific.	P4
	If we wanted to kind of impress someone who already works in a particular field and if you're referencing more technical expertise and research papers, I think that adds credibility to that type of profile.	P8
Difference	I guess it's just whether there's enough differentiator between the general audience and the knowledgeable audience.	P8
	I can't really understand the difference between the original and the general audience. In my view, the original should be for a general audience. It should just be straight talking nice and clear and concise.	P5

Theme	Code	Participant	Excerpt
Accuracy	Accurate	6	[Image] 'OK, so that's the right person.'
			[Overview] 'I'm just gonna Scroll down and check out the overview. It's correct.'
		9	[Image] 'It is definitely him, yes.'
			[LinkedIn] 'OK. Yeah, that's definitely her.'
		4	'We've got name, title, school and external social media presence.'
			[Overview] 'Yeah, Jamie does this. He's involved in this, that looks and user friendly from the p
		1	[Social media presence] 'It's obviously worked because all three of his profiles are correct.'
	Outdated	6	'It's a little bit out of date now actually ...
			I think she's just emitted from that, but to be honest, I think the source text wouldn't have been
		1	'He's actually no longer the director of research, so he obviously hasn't updated that on his prof
	Wrong	4	[Research Interests] 'Wildlife research is not necessarily how I would and characterize his work
			[publications] 'That's interesting because that doesn't look like it's anything to do with Jamie C
			[Image] Obviously it's not the right picture, but if I go into edit content, it should give me the op
			'Not correct. Then, that's really funny.'
Relevancy	Relevant	6	'OK, so uh, I'm reading that she's received the University Chancellor's Award for Rising Star in
			'. . . That's really interesting. Glad that's there.'
			'The research themes look good to me. I think that's what she would say herself.
			. . . again that looks good. Very current.'
		1	You've got his role and his title and where he's from.

		10	'… Well, that's those two things are interesting. I'm interested in those so multi agent systems [Publications] 'Yeah. So that's interesting' [projects] 'And so those are quite interesting again.' '… so relevant work, publications, projects and videos is quite useful'
		7	'it looks it looks like a pretty good overview, and you know from that you could be definitely ge
		1	
	Irrelevant	9	'The overview is a lot of text to have to pass, so if it was possible to summarize it in a way so ei
		8	'Well, I don't really care about that and I want to know what he can do for me.' '… Again, I don't really care about that and I sort of, so maybe I know it already and that's wh 'I mean, again, that's interesting. It's not interesting to me. It might be interesting to someone v
		10	[videos] 'I guess you just have to be a bit careful, you know, attaching something that's not rele
		5	
Utility	Start with Standard Profile	6	'having a foundational document that's automatically generated like this would be fantastic' 'That's really good because that's the sort of fiddly thing that we might try to do that. The syste 'I think it's looking really good. That's why, and I'm excited to use it and going forward.'
		7	'And there's plenty of links on there to do more exploring on our on other pages to find even mo 'I think it was good.'
		1	'we'll start creating biographies for academics that are far more professional.'
		9	this is basically I would expect to use a standard profile when I'm researching the academic…
		10	'I would probably use the standard one, which I could just tweak myself..., and because the oth 'if you use the sort of standard profile but edited it yourself a little bit, I think there's more stand

Start from Scratch	P7	‘I can see how that might be useful for a BD’.
		‘I think the process is great. I think that’s exactly what I would expect, is to be able to have a to
	P6	‘Ah, so this is what I was talking about before… the choice of things.’
	P4	‘I like the starting from scratch approach.’
		‘I do actually really like the idea of this. Mainly because it’s not only are you building what you
	P8	Oh, this is good. Sometimes what I find is that academics will be associated with something in
Share with external partner	P7	I can create a profile and share it with multiple external partners by just basically going in there
	P1	I really like this though, because it does make you double think like or should I? And yeah, sho
	P3	That will let me go to my external partner. Perfect. Really good.
Verify with academics	P6	I think it’s really important to make sure that they have approved it.
	P7	‘so Mirella has to go in and verify this stuff. OK, that’s good to know.’
	P1	Is it the academic themselves that would verify a profile? … If people got content written wron
	P4	I think one of the issues is around, particularly if you want verification from the academic is arc
		So I think having an overview, a sort of standard biog that’s as complete and as up to date and t
	P8	‘I think that’s a good thing. I guess if you were BDE and you might be nervous about sharing s
	P6	‘what happens when you try and search here and it’s not verified. OK. So we could send it to he
Profile List	P4	‘What might be quite confusing is if over time I can imagine everybody wanting or either consc
		‘Otherwise, I think it’s good.I think having and having a Bank of profiles that I personally have
	P3	‘I just know how people behave and you’ll end up in here with about 50 different profiles for hi
		‘what I’m saying if they if there’s that option, that’s fine, but we need to give them some indicat
	P1	‘I think it should be that Miguel has a standard profile that’s generated automatically and then a

		‘It’s not such a bad thing to have different versions and to have the person who’s created them.
	P7	‘So, people would see that and go OK, so [user] made two copies. Let’s have a look at both of t
Make a copy of the profile	P7	‘I like the fact that there’s a mega copy because that means that I’m assuming that means that I
Edit Content	P7	‘I can see how that might be useful for a BD which is like to edit the overview, if you have shar
	P4	‘You’ve got the full profile here and then you can just tweak it.’
Overall Experience	P4	‘It’s a great resource and I can see a lot from the conversations that we’ve earlier conversations
	P5	I think just from their feedback from users, if you have both functionalities available then peopl
Auto-Complete	P9	‘I do like the fact that it does the look up, so that’s a really good.’
Choose image/video	P9	Great. I get to choose image. Cool.
	P1	If we had this tool up and running for the BD community, and either you send a link or you crea
	P1	It’s quite good that it’s got a whole lot of academics that we have.
	P6	Yeah, this looks good and so. If we clicked on one of these, we could have a video from there.
	P6	Videos. Oh cool.
	P1	Ohh wow, you got videos as well.
		Yeah, I think that’s really good.
	P8	I think it’s good to have these related websites down there and it’s very clean and clear.
	P3	OK, so now if I click on this this should open his relevant perfect very good again opening in a