

TRINITY COLLEGE DUBLIN

SCHOOL OF COMPUTER SCIENCE AND STATISTICS

PHD IN COMPUTER SCIENCE

Gender Effects in Interactive Interface Design

Author:
Milena RIBEIRO LOPES

Supervisor:
Dr. Carl VOGEL

Submitted to the University of Dublin, Trinity College,
April 4, 2021



Coláiste na Tríonóide, Baile Átha Cliath
Trinity College Dublin

Ollscoil Átha Cliath | The University of Dublin

Gender Effects in Interactive Interface Design

Approved by Transfer Committee:

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Milena Ribeiro Lopes

Dated: April 4, 2021

Acknowledgements

I would like to acknowledge CAPES foundation for funding this research.

I would like to express my gratitude to those who helped me to get through my PhD research.

My supervisor, Prof. Carl Vogel, for being patient, kind, and helpful during all these years, for the brilliant insights, and for making my time in Trinity a less complicated experience. My previous supervisor Prof. Nick Campbell who first offered me a place in the PhD program, and found me a great supervisor before retiring. Prof. Tiago Barros who has always supported me in my career and fully supported my PhD application.

My friend Kevin Doherty who always gave helpful feedback about my work, helped me with revisions, and also lent an ear when things seemed difficult. My TCD colleagues Justine Reverdy, Camille Nadal, Andreas Balaskas, Ash Alsulamaïne, Erwan Moreau, Carmen Klaussner and Zaynab Salman, who became good friends and also gave me full support in my research.

My boyfriend Tiziano Panzino for taking care of me, for being present 100% of the time, and for making the last years of the PhD more tolerable. My children's father, Gabriel Rabelo, for support throughout these years, for moving to Ireland so that I could pursue the PhD, and for sharing responsibility for and time with the kids. My parents, stepmother, and siblings for always supporting my decisions. And, finally, my children Brigitte and Clara Luna for embarking on this adventure with me, being patient when I could not be entirely present, and for making my days brighter.

This study was financed by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) - Brasil - Finance Code 001

Milena Ribeiro Lopes

University of Dublin, Trinity College

April 4, 2021

Associated Publications

Book Chapters

Lopes, M. R. & Vogel, C. (2019). Gender differences in online dating experiences. In *It Happened on Tinder: Reflections and Studies on Internet-Infused Dating*, A. Hetsroni and M. Tuncez (Eds.), (p. 32-48). Amsterdam, NL: Institute of Network Cultures.

Lopes, M. R. & Vogel, C. (2017). Gender bias on Tinder: transforming an exploratory qualitative survey into statistical data for contextualised interpretation. In *Computer Supported Qualitative Research, Advances in Intelligent Systems and Computing series*. A. Costa, L. Reis, F. Souza, & A. Moreira (Eds.), (Vol 71, p. 225-236). Cham, CH: Springer.

Journals

Lopes, M. R. & Vogel, C. (2019). Is your application gender biased?. In *International Journal of Marketing, Communication and New Media* (Vol 7, n. 12, p. 103-122).

Conference Papers

Lopes, M. R. & Vogel, C. (IN PRESS). Gender effects in mobile application development. In *Proceedings of the 1st IEEE International Conference on Human-Machine Systems (ICHMS)*.

Lopes, M. R. & Vogel, C. (2018). A user-study method to investigate gender bias in the design of mobile applications. In *Proceedings of the 7th Ibero-American Conference on Qualitative Research* (p. 432-441). Aveiro, PT: Ludomedia.

Lopes, M. R. & Vogel, C. (2017). Women's perspective on using Tinder: a user study of gender dynamics in a mobile device application. In *Proceedings of the 35th ACM International Conference on the Design of Communication (SIGDOC '17)* (Article no. 12, p. 1-10). New York, NY, USA: ACM.

Vogel, C., Lopes, M. R., & Esposito, A. (2017). Gender differences in the language of the Map Task dialogues. In *8th IEEE International Conference on Cognitive Infocommunications (CogInfoCom 2017)* (p.151-156). New York, NY: IEEE.

Abstract

The growing interest in the impact of gender on technology brings attention to some concerns with regard to gender bias in design and its implications for the user experience. A first exploration with users of dating applications revealed that women felt frustrated using the most popular application and did not feel fully respected, indicating that their needs were not taken into consideration, possibly due to the misrepresentation of women in technology and, consequently, in the design of the experience. Thus, the purpose of this research was to explore the effects of gender biases in the design of mobile application.

This research on gender, design, and online dating apps revealed gender differences in the appraisal of online dating experiences and in the definition of the design project's requirements. The investigation concentrated on the man-woman polarity and was composed of three user studies that mixed qualitative and quantitative data. The results revealed that women's needs are more likely to be neglected in dating apps, that there are some statistically significant differences in how men and women take decisions while designing dating applications that point to gender bias in design, and proved the feasibility of employing gender-neutral tools during the design process.

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Chapter 1

Introduction

The advance of gender studies and the inclusion of gender equality in the political agenda brought to light aspects of gender differences in the use and development of technology. Some studies (Williams, 2014; Oudshoorn, Rommes, & Stienstra, 2004; Friedman & Nissenbaum, 1996) point to barriers in the inclusion of women's perspective during the design process and reveal gender differences in users' preferences and users' creative outcome. Those differences are disregarded due to the predominance of men's perspective in the tech industry caused by gender dynamics deeply rooted in social interactions and creative processes.

The way people interact with mobile devices and communicate with other people through them is determined by a set of social ideas that are implicit in technology. The present research aimed to analyse how gender impacts the design of mobile applications. The starting point for this research was interviews conducted with 40 women who mainly experienced sexist behaviour while using an online dating application. From these first results rose the idea that applications could stimulate a particular behaviour and, consequently, the need to investigate implicit gender biases in the development of applications. To streamline the research, attention was given to one single service; online dating was selected as the case study for the investigation on gender biases in design.

In this research, the concept of "gender" is used instead of "sex", for the focus is given to differences that emerge from a patriarchal culture and, accordingly, from gender roles. Gender roles are shaped by society and they are not underpinned by biological differences. Most authors in the field refer to gender studies and not sex studies when the research is focused on social dynamics that lead to bias regarding femininities and masculinities. The same path is taken here and the whole work refers to "gender" effects and not to the biological ones.

The concept of gender today moves from a binary approach towards a more inclusive and wide spectrum that comprises transgender identities. The commitment to the inclusion of marginalised users is a pillar of the design field and crucial in the user centred approach. This research is not at odds with gender inclusivity and the wide spectrum of gender. However, exploring issues that are related to a man-woman dichotomy lends a historical weight to the shaping of social interactions and gender roles. Hence, it is assumed that man-woman interaction comprises historical patterns of behaviour that can be reproduced in new technological developments

and that that sexist behaviours can be incited by the user-mobile device interaction, negatively affecting women's empowerment and gender equality.

Thus, in order to investigate the impact of gender in mobile application design, the research is focused on a man-woman binary approach to explore gender issues and is underpinned by values of gender equality, gender equity and women's empowerment.

There are several studies within the "gender in technology" literature that explore the implications of gendered products, however, there is still a lack of investigation into the processes of gendering technology (Bath, 2014). The first study of this PhD research revealed gender differences in the experience of dating apps that were possibly caused or worsened by gender bias in design. In order to suggest design tools or methodologies that enhance gender awareness and tackle biases, it is important to understand the mechanisms that make the assumptions about gender problematic (ibid.). For this reason, this research aimed to understand whether there were gender biases in the design process before exploring tools that could mitigate those biases. The hypothesis that differences in men's and women's experiences of dating apps could be caused by gender bias was explored in a consecutive study on gender effects in the production of design requirements in which a gender-neutral approach was used. Differences in how men and women make decisions and prioritise aspects of the user experience were brought to light. A gender-neutral approach was adopted to provide participants with an unbiased description of a user, which proved feasible to be used in the design process, since the majority of participants could not perceive the absence of gender in that neutral description. Thus, a study on the effect of gender-neutrality in the description of users was carried out in order to understand whether the concept would lead to requirements that include both women's and men's needs. The results revealed that, in fact, gender neutrality could be approached in order to promote the inclusion of both men's and women's needs in a balanced way in a design project.

This document is structured in eight chapters: the introduction, the literature review, the research methods, the study on the experience of dating applications, the study on gender biases in design, the study on the influence of personas' gender in design, the integrated discussion and the conclusion. The literature review presents an overview of the user experience of mobile devices, the impact of social gender roles in science, technology and design, and in the context of online dating - which is the case study for this investigation. In the research methods chapter, the research questions and the relationships between questions are explained. Detailed description of the methods used in each study is provided within the relevant chapters, for each study has a different research design. In the study on the effect of gender on the experience of dating applications two explorations are provided: one with women users alone and one with both women and men users. The second study refers to the investigation of gender bias in the design of mobile apps. The third study explores the use of gender-neutral personas as a tool to promote the inclusion of gender needs in a balanced way in the design process. The integrated discussion provides an overview of the results of the three studies and the literature review combined. The conclusion chapter brings to attention the impact of gender in the context of the intersection of women's rights and technology, as well as ideas to be explored in future research.

Chapter 2

Literature review

The topics of this literature review concern the effects of gender in mobile application design and provide an overview of social gender dynamics that impinge on communications through online dating services (ODS), which is a focal point of this PhD research. This chapter introduces notions about the design process in mobile app development, the impact of gender in this process, the promotion of gender awareness through a user-centred perspective, existing strategies to counteract problematic inscriptions of gender, the concept of personas (to which focus is given in the construction of the research methods), and theories of gender studies and hookup culture which play a role in the adoption of ODS. These notions together provide foundations for understanding the process of inscribing gender in technology, the implications of gender bias in shaping social dynamics through dating applications, and the effects on the user experience.

2.1 The mobile interactive experience

To assess whether gender, as a factor, affects the design of communication through mobile applications, this research relies on the graphical user interface (GUI) as the main channel of communication through mobile devices and is underpinned by theories from interaction design, gender studies, and HCI fields. The GUI communicates a plan for the interaction between users and a service (Petersen, Iversen, Krogh, & Ludvigsen, 2004; Bannon & Bødker, 1989). Such an interface is the result of the motivations to develop the application, of the technology available, and of the knowledge about the user experience (related to either the activity or the manipulation of the GUI). The motivations ensure that all the tools are available to complete the tasks involved in that activity (that motivates the use of the application). Technology supports the completion of tasks by providing tools that render the process more efficient and provide joyful and pleasant experiences. Mobile technology has a multimodal quality, for which multiple channels of communication are available to make phones efficient, usable, pleasant, friendly and so on. The user experience guides the user in manipulating an interface according to his/her previous experiences of mobile phones. For example, there is a set of gestures such as drag, drop, swipe and scroll that users had to learn from the moment smartphones evolved to include touch screens, which expanded the possibilities for interactions through the GUI. Once users have learnt how to manipulate the

information via a touch screen, they are very likely to try that known set of gestures to achieve their goals. The way that gestures, interface behaviours and user behaviours are planned, employing technological developments to enhance the multimodal communication, is what interaction design is about.

Interaction Design is a discipline that pervades many fields of study, however, it established its boundaries between Design and Computer Science, in the field of Human-Computer Interaction (HCI). HCI can assume the goal of being more usable and useful (Carroll, 2003), but the reason for being usable and useful is to provide pleasure during communication with devices, which can only be possible when the field focuses on understanding users, their emotional needs, the social context and how those attributes affect each other. Interaction design, in turn, is more related to devices with a screen or robotics, although its core idea suits many other creative areas. Saffer (2007) proposed five elements of interaction design – space, time, motion, appearance, texture and sound. Fling (2009), in turn, lists some elements of mobile design: context, message, “look and feel” (the author’s word for appearance), layout, colour, typography and graphics. The interface interaction comprises all those elements, however, it is necessary to go further, to cross the boundaries of aesthetics and to deepen our understanding of the communication established through the GUI. In the realm of technological developments, the research on the implications of gender bias in design raises an important concern to be explored within the field and around which this research is developed.

The field of design is well served with a solid design process. The understanding of this process is key to investigating the presence of biases in the design of mobile interfaces. The design process itself is based on steps to achieve the creation of a solution for a product, service or space. Herbert Simon (1969) was the first to define design as a science. The author brought the first principles and guidelines to analyse problems and choose solutions that later would shape the design process, which is also known as design thinking. Through a painstaking analysis of the approaches to imperative and declarative logics in natural sciences, the author explains how the logic of design adds a different perspective to find alternatives that are missing in those two logical approaches (H. A. Simon, 1988). This way of thinking and approaching problems is what makes design thinking a revolutionary tool today, not only to designing products but also in guiding the decision making processes of corporations. Contemporary models of the design process are all based on the principles set by Simon. A largely accepted model is the one proposed by the Hasso-Plattner Institute of Design at Stanford (Doorley, Holcomb, Klebahn, Segovia, & Utley, 2018) that contains five main stages: empathise, define, ideate, prototype and test. In the first stage, the problem or opportunity is analysed so it can be deeply understood; interviews and observations are useful at this point. In the second stage the problem or opportunity is defined and a list of requirements proposed, and it should not happen before studying the users and engaging in dialogue with them in the first stage. The third stage involves ideation, during which designers bring out solutions using creative tools like brainstorming, mind maps, analogies, and so on. In the fourth stage the idea is implemented (developing the idea, prototyping, coding. . .), and in the fifth it is validated, that is, tested with users. Different descriptions of the design process can include more or fewer stages, but these are the basic components. In cases where fewer stages are proposed, some stages are merged into a single one; in the opposite direction, more stages indicate that a single stage can be split into two or more stages. According to Rogers, Sharp and Preece

(2011), for example, the design process involves four basic activities: establishing requirements, designing alternatives, prototyping and evaluating. In this case, the stage of analysing the problem/opportunity was merged with establishing requirements.

Regarding techniques for designing interactions, several are particularly developed in the field and others already used in social sciences and qualitative research. Kolko (2010) lists persona, scenario, ethnography, contextual inquiry and focus group as tools that interaction designers should use for gathering information and suggests tools such as concept map and process flow diagram for helping to design interaction. Not much different from this, Jones and Marsden (2006) in their book, *Mobile Interaction Design*, point out naturalistic observation, focus groups, contextual inquiries, probes and diary studies for gathering information and different kinds of brainstorming and persona for developing interactions. Fling (2009) emphasises that mobile design requires understanding the design elements and specific tools, but it is possible to go further and say that mobile design also requires an understanding of the interaction process and its factors for analysing and designing the user-mobile device communication. Although those tools are insufficient to guide the designer through the interaction process and its factors, they are going to be used as a basis to analyse the differences in design solutions produced by women and men since those tools are helpful and well-known in the field.

In order to find out what are the effects of gender in the design of the dating experience, the investigation conducted as part of this work is grounded in the design process and field of interaction design, which encompass approaches and tools that are essential to assess whether and how gender impacts in the development of the interface. Moreover, it is important to investigate the aspects of gender dynamics that are ingrained in social interactions and how these dynamics are transferred to the user user-device interaction and, accordingly, to the GUI.

2.2 The gender spectrum

The gender spectrum is not unidimensional. There are more nuances than a mere classification of gender identities. Apart from gender identity (spectrum between woman and man or the lack of both) which refers to how people perceive themselves, there is also a gender expression (spectrum between feminine and masculine or the lack of both) which refers to how people show themselves to the world. A woman can perceive herself as such and express herself in a more masculine, feminine, androgynous (a mix of feminine and masculine), or neutral way (neither feminine nor masculine). That is, regardless how people feel about their identity, there is still the way how they express themselves, revealing more gender nuances that are important for the interpretation of some of the results in this thesis.

Moreover, there are other aspects that go together with gender identity and gender expression and create even more nuances to the definition of gender: the sexual attraction and romantic attraction. A man, for example, can perceive himself as a man, express himself in a more masculine way, feel sexually attracted to men and romantically attracted to women. This multidimensionality of gender is explained by the concept of the “genderbread person” (Killermann, 2017). The complexity, plurality and fluidity of genders challenge the

binary generalities about man and woman and the essentialist understanding of femininities and masculinities (Faulkner & Lie, 2006). These nuances of gender help to understand how men's and women's behaviour vary in different social groups and contexts. In the computer science environment, for example, many women had to learn to think and act like a man (white geek man, more precisely) (Williams, 2014). Women in engineering are also constantly pressured to play down their identity as women and act as if they were a man if they want to persevere in that workplace culture (Faulkner et al., 2011). In this rationale, tech jobs may attract women that feel belonged in those environments and that expresses themselves in a more masculine way as well. In order to not draw attention to the fact of being a woman, femininities and masculinities are more fluid in those contexts and very important to be taken into account when researching gender differences and preferences in fields dominated by men. The performances of design and computer science students are compared in one of the studies that compose this thesis and some reflection on the topic of gender nuances is brought forward in Chapter 5.

Since this research analyses gender dynamics in relationship formation mediated by computer, it is important to clarify how gender was explored and to bring to light the limitations of the studies. This research was limited to the analysis of gender effects from a women-men perspective since the idea was to explore the impact of this historical dynamic of gender roles in the user experience and design of dating applications. Moreover, adopting a wider spectrum of genders would pose great difficulty to the recruitment of a minimum number of participants in each study that could be analysed statistically. Since that was not the purpose of the study (to analyse the experience and bias of a wider gender spectrum), only answers of men and women participating were analysed. Since it was not revealed to participants that gender was being analysed, everyone could participate. The query about participant's gender was posed as open-ended question in order to not suggest the gender options.

With regard to sexual and romantic attraction, the preferences were merged in one single motivation (what users were looking for during the experience of the dating app), with no distinction of sexual or romantic motivations. It is important to address that for one study it was necessary to filter participants by their motivation to use the service in order to analyse the man-woman dynamic with statistical tests. Hence, in that case, only answers of men looking for women and women looking for men were analysed. However, this research is not at odds with the variety of sexual and romantic preferences; the focus in the man-woman heterosexual polarity makes the analysis practical considering the research goal and a statistical point of view. That is, even if analysing homosexual or bisexual dynamics was a goal, it would not be possible to make statistical comparison with such small number of feedbacks from participants that indicated those preferences in that study.

2.3 Gendered design and its social impact in technology

Social beliefs pervade communication among people and the material world, including the technological artefacts they use. Social rules, cultural beliefs, codes of behaviour, among others, shape the development of technology and its use. The process of design is intrinsically connected to the process of inscribing values in technological developments that will shape user-device interaction (Marsden & Haag, 2016). Therefore, design is embedded

with encoded meanings that represent the cultural, economic and political values of a society, which are expressed through social and aesthetic design codes (Buckley, 1986). Social constructs such as gender roles (for more on the gender distinctions used in this research, see the Chapter 1), for example, pervade the development of technology just as it does in human-human interaction. Thus, in the realm of applications, design is also ingrained with social ideas that shape interaction with and through mobile devices. Therefore, the system is ingrained with designers' understanding of it (Winograd, 1986), which includes beliefs regarding users' needs. Gendered representations of users are considered to be an inextricable part of the design process, and those representations guide the inscription of meanings in artefacts (van Oost, 2003).

For example, an experiment conducted by Stonewall and Dorneich (2016) revealed that the perception of professionalism in websites is strongly connected to elements perceived as inherently masculine by users, as dark colours, angular shapes, rugged or business-like images, thick serif fonts and wood or stone based textures. Those dominant codes imprinted in the area of design make room for intrinsic gender biases, that in turn can shape users' behaviour and favour a social group interest in human-human interaction mediated by computers.

2.3.1 Gendering mechanisms and gendered artefacts

Corinna Bath (2014) points out four mechanisms that lead to gendered computational artefacts, which are elaborated below:

1. The use of "I-methodology" in the design process;
2. The inscription of gender stereotypes and underrepresentation of a gender in design groups;
3. Gendered concepts of bodies and behaviour in technology;
4. Misconceived ontological and epistemological assumptions.

The I-methodology coined by Akrich (1995) refers to the process of designing services and products based on designers' own ideas, values, beliefs and priorities. In this process the representation of the user is not grounded in data from real users but in a projection of how the designer perceives the user (Marsden & Haag, 2016) and the resulting interfaces and artefacts are infused with designers' perspectives of what is important and what is not to the project, according to their own experience and judgments of reality.

The inscription of gender stereotypes refers to the materialisation of designers' implicit or explicit interpretations of gendered user representations in the products they design (Oudshoorn et al., 2004). Akrich (1992) introduced the notion of "gender script" to explain how those biased interpretations of users would shape the use of products and human-artefact interactions. The author explains that designers would often inscribe the technical content of an object with the idea they have of the users' tastes, competences, and aspirations, among others, as if users were actors to whom they can define roles just like in a film script. Within this concept, designers would consciously or unconsciously rely on gender stereotypes to represent their users, which would lead to the aesthetic, functionality and behaviour of an artefact to be based on those stereotypical ideas of what

women and men users¹ need and desire. Consequently, that would shape the way men and women would interact with and through that artefact, creating meanings that include the sense of belonging, identity, and expression. Oudshoorn et al. (2004) explain that the context of use is a determinant element of design, through which artefacts can express their gendered meanings, and that the adoption of those artefacts into daily life is a way in which people construct their gendered identities. For example, if a product carries symbols of “traditional femininity” as “easy to use”, “pink”, or “not technological”, it will reinforce the already established gender roles of a traditional gender system.

The underrepresentation of women is mainly connected to the lack of their viewpoint during the problem solving and decision making processes in design teams. According to authors of the “gender in technology” literature, technology has been shaped by a unilateral men’s point of view (Fountain, 2000; Wajcman, 2000; Churchill, 2010), and a stronger representation of women would lead to new ideas and standards, based on a balanced gender perspective that encompasses both men’s and women’s experiences. That is, if there is a feminine point of view of doing things, women’s understanding of science should be integral to its development (Keller, 1985), and they should have an active role in designing technology (Bødker & Greenbaum, 1993). Thus, from the creator angle, the lack of women’s influence in the shaping of technology makes products biased and stereotyped by men’s ideas since it relies on a unilateral perception of users’ needs, products’ functionalities, business opportunities, and so on.

However, the inscription of gender stereotypes and the underrepresentation of a gender in design teams can be treated as two separate issues, for the inclusion of women in design teams is not sufficient to counteract the use of gender stereotypes in user representations, for their influence in a design team is often limited (Williams, 2014; Rommes, 2014). According to authors who studied the performance of women’s participation and influence in deliberative sessions, there are some barriers that undermine women’s leverage in decision making, which are: opinions that exposes gender differences are not voiced during product development (Rommes, 2014); women usually do not feel sufficiently comfortable to raise gender issues in a gender-mixed group (Williams, 2014), and, when the group has divergent opinions, women will only participate to the same extent as men, with regard to speech participation and change of speech roles, if the group is composed of at least 80% women (Karpowitz, Mendelberg, & Shaker, 2012). Furthermore, although the inclusion of women is important for providing a more balanced point of view on creation, tackling gender stereotypes in user representation with the “adoption of more women” alone is not correct, for women designers are not always representative of women users (Rommes, 2014) and, thus, they cannot replace user research and the adoption of design methods that aim to raise gender awareness and provide gender inclusivity in the design process.

Gendered concepts of body and behaviour and the misconception of ontological and epistemological assumptions cannot be explained by gender scripts and stereotypes, which focus on user representations (Bath, 2014). The idea of how human and non-human bodies and behaviours are shaped through technology draws back to activity theory (AT) and actor-network theory (ANT). AT address the mediator role of artefacts (Rogers

¹The discussion of “gender” in technology was first focused on a man-woman polarity and a binary gender system, but this previous focus does not implicate a disregard for non-cisgendered users in the use of such theories today or invalidate those theories, since the idea behind the critique of gender scripts is to move forward towards the design of inclusive technologies.

et al., 2011), in which the body can be analysed as a connector between the individual and the social, the inside and the outside (Blackman, 2008), through which the self is not actually limited to one body, but rather is transferrable between bodies, human or not (Mol, 2002). In a similar fashion, ANT recognises that artefacts embody designers' ideas of interaction and that these ideas prefigure interactions in the use of those artefacts (Wajcman, 2000). In both AT and ANT, the body can be seen as a matter of materialised gender norms (Butler, 1990) and, at the same time, an active agent in the process of this materialisation (Barad, 2003). The results of this permeable quality of human and technological bodies are visible in both machine and human behaviour.

Artefacts' ontologies and epistemologies impact the development of gendered artefacts when the assumptions about the role of gender in shaping reality and gender studies are not taken into consideration or are interpreted in a way that does not trigger a deep investigation of the agents that shape gender identity and, accordingly, social relations. As the construction of gender relations is a fundamental step in the construction of new technologies, for both gender and technology originate from social beliefs whose boundaries are negotiated rather than pre-existing (Ormrod, 1995), it is fundamental to reflect and investigate those social processes and acknowledge the effect of those gender and power relations in the design of new technologies.

Corinna Bath (2014) suggests that there are four mechanisms that result in four different categories of computational (gendered) artefacts (see Figure 2.1): neutral technologies that target "everyone"; technologies for female users; technologies for "the human"; and abstract concepts underlying computational developments.

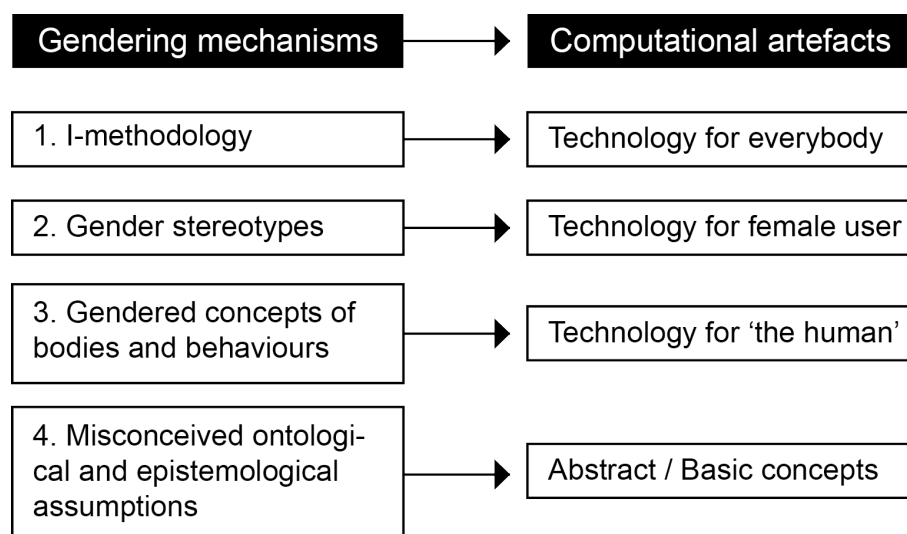


Figure 2.1: *The relations between the four mechanisms and the four computational artefacts proposed by Bath (2014).*

The neutral artefacts that claim to be available for "everybody" should include different types of users and, consequently, a wide spectrum of genders. However, designers usually make the mistake of judging those users' needs based on their own perception (I-methodology) and many times do not address gender as an essential requirement of user research (Bath, 2014), as in the case of the construction of the "digital city of Amsterdam",² in which no effort was made to focus on specific user needs; Instead, design choices were based on designers'

²The digital city of Amsterdam, the "De Digitale Stad (DDS)" was a virtual environment built to stimulate citizens to discuss local politics.

own biased interests, designers who were mostly young and highly educated men (Rommes, Oost, & Oudshoorn, 1999). In that case, a drive for designing a highly technological and innovative environment overruled the initial goal of designing for “everybody” (Oudshoorn et al., 2004). Technology for female users, differently, lends a focus to women’s needs. A female user-centred approach seems useful and important for developing devices that empower women and for addressing topics around the female body, such as female sexuality (Almeida, Comber, Olivier, & Balaam, 2014; Kannabiran, Bardzell, & Bardzell, 2011; Tutia, Baljon, Vu, & Rosner, 2019). However, designing for female users risks reinforcing gender stereotypes (Churchill, 2010; Bath, 2014), for this approach presumes that the group of female users is homogenous and leave no space for nuances. The design of technologies for “the human” that attempt to move beyond gender differences in design usually tend to normalise gender stereotypes instead and to merge conventional binary genders in a mixed-gendered approach (Bath, 2014). The abstract / basic concepts pointed to by Bath (ibid.) refers to basic objects and concepts in the field of computer science such as tools, algorithms, and theories, that fail to acknowledge gender or hide a gender dichotomy due to a traditional computer science epistemology and ontology.

2.3.2 Gender differences in design

Those mechanisms that are in play in the design of products and services can lead to gender bias in design. Gender bias can be studied from two different angles: from the designer’s practice and the user’s experience. Some studies aiming to investigate gender differences in the use of technology or in the production of design reveal findings that support the presence of gender biases in the development of design.

A user study conducted by Moss and Colman (2001) explored gender differences in the production of print design, and the gender preferences of consumers. The authors analysed 227 business cards created by an homogeneous sample of graduates³ from design schools in the UK and found a statistically significant difference between the format and colours chosen by women designers and men designers: compared to women, men more often went for white cards and preferred a standard card size rather than non-standard sizes. To investigate if consumers prefer the design produced by men or women, the authors proposed another experiment in which four Christmas cards (two produced by men and two produced by women) were shown to 35 women participants and 30 men participants who were asked to choose a favourite one. They detected that both men and women tend to prefer cards produced by designers of their own gender without knowledge of the designer’s gender. The study highlighted some gender differences regarding design choices and the relation between designers’ gender and consumers’ gender. In a follow-up study (Moss, Gunn, & Heller, 2006), the authors analysed gender differences in the perception of website design, in which 23 features were rated in order to identify preferences in the use of language and visual features by men designers and women designers. 13 features showed statically significant gender differences. Regarding visual features, for example, the results pointed out that the use of rounded shapes, vertical layouts, colours for typography, irregular typography and informal images determined highly feminine elements. In a second stage of the same study (Moss & Gunn, 2007), five web design features

³Homogeneity, in this case, was used by authors to describe designers with the same educational background and same level of attainment (they did not mention how they have controlled it), however, it does not refer to the gender composition of the sample (114 women designers and 83 men designers).

were individually rated by participants (language, pictures, shapes, layout and typography colours) in order to determine whether users prefer aesthetic elements produced by men designers or women designers. Results show that women tend to prefer websites with more womanly elements while men did not seem to have a strong preference for either gender, except for pictures that men preferred with more womanly qualities.

Although those studies related above indicate an inclination towards certain design elements according to the gender of the designer, they do not explore differences in the design produced by woman designers and men designers when they are asked to develop for the same user. In the business card case, for example, neither the topic nor the target was controlled for: each card was designed for different businesses/companies, and for different individuals (that could be a man or a woman) that have different backgrounds, interests, expectations, occupations, and so on. The same applies to the website study, in which each website was designed for different goals and for different groups of subjects. In the Christmas cards case, topic was controlled for, but because designers were not told to consider the same target group, a big space for personal preferences was left open. Thus, it is not possible to know whether differences emerge because designers are creating for different users and for different purposes. To verify the presence of gender biases in the design process, it is important that both women designers and men designers design for the same subject or group and receive the same instructions regarding the service or product they are designing.

A study on gender preferences (Xue & Yen, 2007) revealed many gender differences regarding preferences for materials, textures, forms, and perceived values, demonstrating that taste is also stereotyped. Czerwinski (2002) found that women benefit more from navigation in larger displays with wider fields of view in comparison to men; that is, they can reach their goals more easily than in narrow displays, while men's performance is not affected by narrow displays. Simon and Peppas (2005) observed that men feel more comfortable with the use of Internet and website navigation than women, but the authors also acknowledge that this difference may occur due to men's domination in technology that results in developments that privilege men over women. Nysveen et al. (2005) investigated the gender differences in the intention to use mobile chats and detected that enjoyment is a strong determinant of intention to use mobile chats for women while usefulness is for men. They found out that expressiveness is a stronger motivation for men users and that they have a high drive for communication, possibly because they feel more comfortable interacting, flirting and expressing their identity and emotions through chat services than in face-to-face interactions. Normative pressure also have significant effects on intentions to use mobile chat services: women reported feeling more socially pressured to adopt technology and to use mobile chats than men, who perceived little social pressure to use the service (ibid.).

Another study in the field of web design (Metaxa-Kakavouli, Wang, Landay, & Hancock, 2018) presented two content-identical websites to 111 participants taking an introductory course in computer science, one with graphic elements (images, font and colour) perceived as masculine and the other with elements perceived as gender-neutral. Six impressions of the websites were measured through ANOVA statistical test: enrolment intentions (in the course), feeling of belonging (to computer science field), anticipation of success (in taking a course), self-confidence (regarding computer science skills), intention to pursue a computer science career, and anxiety generated by gender prejudice (in the field). The results of the study revealed that there was no

significant difference in men's impressions for the two websites while women presented with the masculine website were less likely to enrol in the course ($p = 0.001$), to feel a sense of belonging with respect to the course ($p < 0.001$), to anticipate success in taking the course ($p = 0.01$), to report confidence in their abilities ($p = 0.001$), to express interest in learning computer science ($p < 0.001$), and were much more anxious about how their gender would be perceived in a computer science environment ($p < 0.001$), compared to women presented with the gender-neutral one.

These studies indicate that sensitive social factors that pervade the aesthetics and functionality of the design of the GUI and differently affect men and women users' experience.

2.4 Gender awareness and user-centred design

A common practice in design is to consider the user as fundamental key to the development of new technologies. A user-centred design (UCD) concept brings users to the centre of projects, taking into consideration their opinions and needs from the beginning to the end of the process. In line with this concept, users should be involved in as many stages of the design process as possible, including, for example, determining the problem to tackle, setting requirements, as well as testing and evaluating solutions and prototypes. This approach brought a paradigm shift to design, from drawing attention to technology and the activity to consider users' needs as the main purpose of development. Other approaches also put users in the middle of the design process, as in the case of universal design, that aims for the inclusion of minorities' needs, and participatory design (see section 2.5). This seems to be a growing trend that could increase awareness of gender biases in design. However, there are still some obstacles to the use of UCD, as described below.

Despite the attempt to include users in design, Williams (2014) brings attention to gender bias in UCD: even when process is followed, there are still many design decisions that are made by individuals in the design teams, which are influenced by personal opinions (Akrich, 1995; Fleming & Koman, 1998; Massanari, 2010; Mulder & Yaar, 2006; Pruitt & Adlin, 2006; Williams, 2014). This space for personal opinions can arise for many reasons. For example, companies usually have limited resources to investigate users (Williams, 2014; Portugal, 2008; Oudshoorn et al., 2004) or preference is given to speed up the design process in order to launch products and services as quickly as possible (Oudshoorn et al., 2004).

Considering that development teams are usually composed of 26% women and management positions filled by 20% women (Ashcraft, McLain, & Eger, 2016), developments are likely to be embedded with a men's point of view. Further, Williams (2014) found out that women do not feel comfortable bringing gender issues to teams' discussions either because they have learnt to act and think like men (disregarding women's needs), because they think it is easier to opt for a gender-neutral perspective, or because they do not want to draw attention to the fact of being a woman in a men-dominated group. As exposed before, women tend to exert influence over group discussion only when they represent more than 80% of the group.

These facts uncover some of the implicit issues regarding women's participation, women's leverage and intrinsic power relations that affect the development of technology that are beyond the reach of a user-centred

approach. Hence, taking into account the underrepresentation of women in design teams, the lack of user research in projects, the undermining of women's leverage and influence in decision making process, and that designers are very likely to bring personal opinions to the project, the probability that there are implicit and unconscious gender biases in design is high.

The inscription of stereotypes and gender scripts in technological developments is probably a consequence of gender biases in design. Gender, as a factor, can be explicit or implicit in artefacts; when artefacts are designed for either men users or women users (but not for both), gender is an explicit factor; when artefacts are designed for both, gender is an implicit factor (van Oost, 2003) and there is an unconscious tendency to take decisions considering men as the typical users of technological artefacts (Friedman, 1996; Bradley, MacArthur, Hancock, & Carpendale, 2015). More precisely, unconscious decisions lead to the satisfaction of the interests of designers, who are mainly young, white, and well-educated men (Oudshoorn et al., 2004).

In user-mobile device interaction, aspects of design such as design requirements, implicit biases, and gender scripts as described above are embedded in the system and encoded in the GUI. Therefore, the GUI, as a product of design, can have a substantial impact on user behaviour. The user interface tacitly guides the user through those invisible scripts ingrained in technology. Hence, the GUI shows the user how they should interact in that virtual space, how to pose questions and which answers to expect from the system. That dialogue can be translated into a flow of "actions" (from users) and "reactions" (from the system) involved in the user-mobile interaction. Through the graphical elements, users understand that there is a pre-defined script to stick to. That is, in a mobile application, the set of possible actions and reactions (inputs of the user and outputs of the system) indicates the way users 'should' interact in that environment. More investigation is required to understand the role of the GUI in establishing gender scripts. This research investigates whether gender scripts reinforce stereotyped ideas of masculinity and femininity in relationship formation through dating apps.

2.5 Strategies to approach gender in the design process

This section introduces strategies to neutralise problematic inscriptions of gender in design. From this review it was possible to understand that two types of strategies have been employed for this purpose: one for tackling biases in development (which include gender bias) and another for tackling gender-specific issues. Since many design practices indicated by authors researching gender-related problems specifically derive from the research on bias, this section first presents a summary of strategies employed to minimise bias, followed by gender-aware design strategies.

2.5.1 Strategies to minimise bias

In this subsection three main strategies to minimise bias in design are introduced: "participatory design", "value-sensitive design", and "reflective design". Although these strategies are not focused on gender but embrace gender as a problematic outcome of poor design practice, they are worth mentioning since they provide guidance for addressing gender related issues in the design process.

Participatory design

Participatory design (PD) was established as a design practice originated within Scandinavian countries in which the approach to artefacts changed from shaping things to giving licence to participate in things, from designing for users to designing with users (Sanders, 2002). In the encounter of collaborative design and social sciences, the participatory experience emerges as a design mindset that encompasses a more empathetic attitude towards people (ibid.). Based on this approach, the development of products and services evolved to embrace a more collaborative quality between humans and non-humans; Thus, PD defines the practice in which those affected by design should assume an active role in shaping it (Bjögvinsson, Ehn, & Hillgren, 2012). PD embodies the role of negotiating meanings and identities between stakeholders and artefacts in order to create a space for social innovation, and, therefore, for more significant and empowered interactions. In this approach, the community has a strong influence in the decisions that emerge from a co-participation of users, designers and other stakeholders. That is, the analysis and reflections about the community as a whole are not limited to the evaluation of the impact of the adoption of a new product or service in that society; these reflections give rise to innovative opportunities to be developed to improve the life of those people. In PD users are not only heard but they are part of the team, in contrast with a UCD approach (Sanders, 2002). PD attends to Haraway's (1988, p.580) early call for accounting "earth-wide network of connections, including the ability partially to translate knowledges among very different – and power-differentiated – communities".

The practice is supported by the concept of "sociomateriality" that proposes an expansive analysis of the differences within human-machine configurations in a process of "expanding the frames" of design to embrace networks of social and material developments, to recognise agencies in the process, and to acknowledge responsibilities through reflection on "situated actions", in order to understand the "inevitable cuts" in the social and material realms linked to human-computer interaction (Suchman, 2007). By "situated actions" it is possible to realise that each action impacts on material and social circumstances that should be accounted in a design plan that represent the embodied actions, and by "inevitable cuts" one can understand that boundaries are inevitably designed in the shaping of artefacts (ibid.). Thus, designers should grasp a wider view of the implications of their projects (expand the frames) in order to make decisions (cuts) that will unavoidably impact the sociomaterial configurations. "The only way to find a larger vision is to be somewhere in particular" (Haraway, 1988, p.590), somewhere in which "situated knowledges" about communities is accounted for in order to supportively and responsibly translate the "cacophonous visions and visionary voices" of the subjugated (ibid.).

PD also relies on the knowledge that comes from the relationship between material bodies (Butler, 1993), through which entities are mutually and constantly shaped. From this point of view, things cannot be separated from subjects (Berg, 1998; Barad, 2003) since it is exactly in this relationship that meanings and senses emerge. In this context, agential "intra-actions" between human or nonhuman bodies (or both) produce observable phenomena - causal material performances (Barad, 2003). The term "Intra-act" defines the ability to act (agency) that emerges within (and due to) the relationship between two bodies, but not among them such in an "interaction", which presupposes pre-existing agencies and independence among them. Because agencies do

not consist of human or machine behaviours but of intra-actions between the two, designers should investigate how to shape artefacts so people can responsibly and reiteratively intra-act (Sefyrin, 2010). In the study of technologies, for example, researchers can gain more perspective by analysing the interface as “mediator” rather than as “object” (Bødker, 1989). The idea is “not to assign agency either to persons or to things but to identify the materialisation of subjects, objects, and the relations between them as an effect, more or less durable and contestable, of ongoing sociomaterial practices” (Suchman, 2007, p.286).

Hence, PD values the meanings that emerge within the relationship between people and devices, some of which can impact upon users’ behaviour. As a tool to minimise bias, the sensitivity to meanings that emerge from the use of technology and a comprehensive approach to the role of things in shaping behaviour yields a wide view of the project that helps designers to make the best decisions to improve the user experience.

Value-sensitive design

In the framework proposed by Friedman (Friedman, 1996) that resulted in the development of the value-sensitive design strategy (VSD), the author relies on two core values in the attempt to produce meaningful reflection in the design process: “user autonomy” and “freedom from bias”.

The first value refers to the users’ ability to control technologies by deciding, planning and acting when autonomy is given to them. However, some aspects of the system that undermine their autonomy are found in “system capability”, and in “system complexity”, in the “misrepresentation of the system”, and in “system fluidity”. When technologies do not provide the user with the capability to achieve their goals, when their tasks are achieved with excessive effort, when the user feels frustrated because the system’s functionalities are not clear enough or do not update alongside users’ fluctuating preferences, they are likely to undermine users’ autonomy and, accordingly, users’ self-confidence. The “freedom from bias” refers to the practice of preventing biases that are rooted in the development of technology and can also affect the human-computer interaction.

Friedman and Nissenbaum (1996) point out three types of biases implicit in software development: pre-existing, technical and emergent biases. Pre-existing bias refers to social beliefs that are embedded in technology (e.g. gender roles) and exist independently of the system. Technical bias refers to the constraints of technology, such as algorithms that fail to recognise nuances between groups of users and lead to non-inclusive features. For example, the massive adoption of GUIs has excluded many visually impaired people from technology. Emergent bias, in turn, appears after the implementation of the system and refers to changes that occur in the society that could not be predicted or a mismatch between the user created by the design team and real users.

Friedman (Friedman, 1996) suggests that a commitment to identify biases and to negotiate systems’ specifications in the early stages of the design process would lead to a VSD practice that, in turn, would lead to the creation of techniques to minimise biases.

Reflective Design

The claim for “reflection” seems to appear very often in the literature on “gender in design” as a crucial element for understanding users and including women’s and non-binary groups’ perceptions in the design process. For

example, Churchill (2010) argues that designers should reflect on the assumptions of use and user and on how these assumptions could be either reinforcing behavioural norms or challenging them. Similar to that, Brulé and Spiel (2019) propose a systematic reflexivity in order to constantly negotiate identities which are co-constructed between designers and participants in PD. Indeed, a “reflective design” (RD) approach was proposed as an alternative to counteract unconscious values inscribed in technology (Sengers, Boehner, David, & Kaye, 2005).

In RD, six principles are proposed (ibid.):

1. Designers should use reflection to uncover and alter the limitations of the design practice;
2. Designers should use reflection to understand their role in the technology design process;
3. Designers should support users to reflect on their lives;
4. Technology should support scepticism about and reinterpretation of its own working;
5. Reflection is not a separate activity from action but is folded into it as an integral part of experience;
6. Dialogic engagement between designers and users through technology can enhance reflection.

By following the first principle, designers would be able to identify unconscious values and assumptions from the very beginning of the design process, to detect biases and perspectives ignored in the construction of technology, to develop methods that provide a wider view and inclusivity, and to stimulate debates within the area. By following the second principle, designers would make conscious their role in the design, acknowledging their experiences and expertise. By following the third principle, designers would be able to come up with tools to help users to be aware of their activities, struggles, experiences, expectations, and so on. By following the fourth principle designers would use technologies to help users to explore their own skills, blockages, and cognitive and physical constraints, while at the same time they would gather data for analysing users' performance. The fifth principle suggests that reflection during users' tests and on the data collected is crucial for a richer understanding of the stage of data analysis and for improving the next stages, which should derive from previous reflections. The last principle suggests that designers and users should reflect together on issues and opportunities, as highlighted through approaches such as a PD and VSD.

Furthermore, some strategies are proposed:

1. Provide for interpretive flexibility;
2. Give users license to participate;
3. Provide dynamic feedback to users;
4. Inspire rich feedback from users;
5. Build technology as a probe;

6. Invert metaphors and cross boundaries.

From “interpretive flexibility” one can understand that designers are responsible for the process of creating meanings, in which designers and users co-create those meanings, and for coming up with tools that help in this flexible reflection such as “making the familiar strange” (Bell, Blythe, & Sengers, 2005). By providing users “license to participate” designers would make sure that users will feel comfortable enough to participate in sessions that involve methods and tools they are not familiar with. “Providing dynamic feedback to users” seems to improve the reflective process since users can have access to data collected and reflect about it from a different perspective (from the designer’s one). Designers’ choices for methods should strive to obtain “rich feedback from users” in order to stimulate users to reflect and, accordingly, to provide designers and the project with richer information. From “building technology as a probe”, one can understand that designers should develop or use new technologies in order to help users to reflect and to provide feedback about design, about themselves, about the social dynamics in which they are immersed, and so on. Furthermore, designers can invert known metaphors in order to incite reflection and to make room for the development of innovative technology. In design, metaphors are used to explain and to understand abstract concepts underpinning the system (relationships, interactions, activities, and so on). In this context, a shift between dominant and marginalised metaphors can provide new perspective on the problems.

2.5.2 Gender-sensitive design strategies

In the attempt to move forward with regard to gender-inclusivity in the development of new technologies, several authors have analysed how designers have been addressing gender in the design process, and reflect upon the issues and opportunities that come up through the use of different strategies.

Common strategies to address gender in the design process

Rommes (2006) observed that design teams would often use three strategies for addressing gender in the design process:

1. Design relying on gender stereotypes;
2. Design with I-methodology;
3. Design approaching participatory design.

The concept of gender stereotypes and I-methodology were already explored in the previous section, however the author makes several additional points worth mentioning, since the original version of the strategy does not address gender. One issue related to the stereotyping method was that designers considered it important to define what were feminine and masculine features but there was no attempt to reflect upon how the stereotypes were invoked. No matter which type of woman user was defined as a target group, if it were a highly educated one or

a woman living in a disadvantaged area, the same stereotypes would emerge, as if the population of women were homogenous and they would all have the same needs and tastes. For the author, the positive side of designing with stereotypes is the attempt to meet women's needs. However, the assumption that it is not necessary to rely on stereotypes in order to address women's needs is supported in this literature review (see section 2.6) and, later, in the results of the third and fourth user studies of this thesis (see chapter 5 and 6).

The version of I-methodology observed in design teams by Rommes (2006) was different from that first described by Akrich (1995). The process observed by Rommes involved highlighting gender, which the author defined as a "reflexive I-methodology". The companies who took this approach would tackle gender issues in design by adding more women designers to the team. With this decision, the perspective of women would be considered in the project and lead to a more reflexive decision making. Yet, as already argued, women designers cannot replace women users since they are not always representative and the I-methodology is based not in the users' perspective but rather on the designer's own judgments about what is useful and desirable. Rommes (2014) concluded that a reflexive thinking approach would be more adequate if there was a real attempt to understand and get to know the diversity of users and their complexities through user research.

From designing from gender stereotypes and I-methodology strategies it is clear that in both methods designers assume a difference between men and women. When designing with PD and user testing, more effort is devoted to understanding users, making room for a focus on user needs rather than on gender labels (Rommes, 2014). However, the author (*ibid.*) argues that this approach is rare in industry.

Undoing design and de-gendering design strategies

From this introduction to strategies that will lead to more gender-sensitive design practices, it is clear that the advancement of gender awareness should not necessarily rely on highlighting gender differences but, on the contrary, should be based on user research and user needs. Akrich (1992) indicated that a "de-scription"⁴ of technological objects would be a way of dealing with the disregard of users' needs through negotiations between innovators (investors and designers) and potential users. Following this line of thinking, Van der Velden and Mörtberg (2012) pointed out two strategies posited by the literature to address gender-sensitivity in the design process without stressing gender differences: "undesigning design" as proposed by Brigham and Introna (2007) and "degendering design" as proposed by Bath (2014).

In their analysis of how politics and ethics play a conflicting role in shaping technologies, Brigham and Introna (2007) suggest that a design that embraces these tensions, in which neither one nor the other dominates, would result in a process of "undesigning the design". Within this process, a transparent design, which is open to the scrutiny of many players (investors, designers, users), will afford multiple and diverse interpretations of design. In this case, the use of the strategy would enhance the inclusion of perspectives without relying on the politics of gender or on the ethics of "correctly" addressing gender, but rather would open up space for materialising a morality based on the interest of multiple players. Similarly, Cassell (2002) suggested the concept of "undetermined design", through which it would be possible to focus on the technology itself and

⁴Akrich uses the term "de-scription" to refer to the act of removing (or avoiding) gender scripting of technological products

“allow users to engender themselves, to attribute themselves a gendered identity of any one of a number of sorts, to create or perform themselves through using technology” (Cassell, 2002, p.12-13). This approach could be useful if the gender issues that lead to the exclusion of some groups were solved. As the author explains, a phase in which design relies on “no viewpoints” would follow a phase of relying on multiple viewpoints (ibid.).

In a different way, Bath (2014) proposes a “de-gendering design” approach as a strategy to reduce gender biases in the development of technology. The author explains that the approach focuses on removing undesired inscriptions of gender in technology through the use of user-centred concepts such as PD. However, as said before, user-centred tools do not bulletproof design. Moreover, it is central to distinguish stereotypes from gender differences, since genuine gender differences such as those revealed in the studies mentioned here should be addressed in the design as part of women’s and men’s needs (which in a more expansive context would include non-binary groups’ needs).

Van der Velden and Mörtberg (2012) understand these two strategies as attempting to remove inscriptions and meanings of gender from design (“de-do something”) and attempting to reverse to a previous state of design (“un-do something”), a state in which design was not influenced by meanings, inscriptions, frameworks and techniques. On one hand, by “undoing design” a continuous state of challenging gender norms and their inscriptions in technology is created, however, on the other hand, any successful method or tool to reduce gender bias will be lost in the constant undoing process, which may not look realistic given that the design process is always time-constrained. Thus, an “undoing design” strategy suggests that any important advancement in the field would be (constantly) ignored. How, for example, would designing under this approach interact with other problems such as the underrepresentation of women in design teams, the lack of women’s influence on projects, and the misrepresentation of women users in user research? In a “de-gendering” strategy, in turn, advancements in tackling gender bias could be incorporated into the process. The use of genderless or neutral tools such as the “gender-neutral persona” explored in Chapter 6, for example, may help to remove the focus on gender in order to design for more gender-inclusive needs.

It is possible to conclude that “undoing” design is a strategy that requires time and the participation of representatives of every actor in play (users, designers and investors), that it can be useful to find the true priorities in a project, and that gender and gender inscriptions will come up naturally. However, that strategy can only be helpful if other problems that recently came to light in the literature are taken into account, so it does not clash with the initial purpose of counteracting problematic inscriptions of gender. A “de-gendering” strategy may be more realistic approach since it takes into consideration all the efforts made so far to counteract the inscriptions of gender in design and acknowledges the well-known and widely used design process and design tools consolidated in the design methodology. However, neither Brigham and Introna (2007) nor Bath (2014) provided concrete examples of how those strategies would be implemented, nor indicated cases in which they were. Thus, so far, the two strategies have not been tested in order to demonstrate their feasibility and, moreover, there is no indication of which research methods, tools and techniques should be employed to achieve these goals and test the feasibility of these strategies.

For the development of this PhD work, these strategies are acknowledged as the most contemporary efforts to tackle problematic inscriptions of gender in the design process. The efforts made so far are limited to theoretical suggestions that are a good starting for the inclusion of “gender thinking” or gender awareness within the design process. Although the theories and experiments within the field indicate that gender biases are very likely to occur, they do not reveal whether gender bias occurs when men and women are provided the same tasks and same descriptions of users and services (personas and scenarios). Moreover, practical tools to address gender in the process of design are missing, with a few exceptions such as one study involving gendered personas (Gender Mag), as described in the next section.

2.6 Designing with personas

The process of designing applications is underpinned by the design process and by interaction design tools such as personas, scenarios and user journeys. Those tools were developed in order to better understand users and complement each other; together, they help to visualise how the communication between user and application is supposed to happen. Personas consist of a narrative description of a fictional character that represents a group of users. This user representation is used to help designers to engage with users and to understand their needs (Cooper, 1999).

Persona is a tool to understand users’ needs and is widely used to develop design solutions, to improve communication within the company and to facilitate dialogue between stakeholders (designers, investors, users, and the community). The description of a persona encompasses information regarding a typical user’s lifestyle, preferences, motivations, attitudes, personality, frustrations, and so on. Instead of using demographic information and numbers to refer to a group of users, a persona depicts a fictitious character (based on data gathered from real users) that has a name, surname, age, gender, music taste, food preferences, a life story, a job, a precise income, specific goals to achieve, frustrations to deal with and other genres of information. It is a representation of users that should be grounded in data collected from users before the definition of the project requirements in order to ensure that users are well understood and the artefact well designed, meeting users’ needs (Kuniavsky, Moed, & Goodman., 2012). It is easier to empathise with users through personas than through demographic information because personas are pictured as real persons, although they represent the qualities and needs of a whole group (Marsden, Hermann, & Pröbster, 2017). This character plays a role in the use of other interaction design tools, and usually goes together with a scenario - a description of the context of use of the service. This is the reason why personas are so popular and one of the first tools to be used in the process of designing applications.

However, when designers (or developers) do not ground the representation of users in data they are likely to configure the user just as they configure products and to neglect real users’ needs (Oudshoorn et al., 2004). In this context, designers can try to design the perfect user for their product rather than to design a perfect product for the end user (Saffer, 2007) and they will probably define requirements and attribute features that they consider useful (Massanari, 2010), many times as if they were the users themselves (Akrich, 1995; Fleming & Koman, 1998; Pruitt & Adlin, 2006). Moreover, when designers try to design imaginary personas that are

not grounded in data but on their intuition, these user representations are likely to incorporate stereotypes (Saffer, 2007) or to reinforce existing stereotypes (Marsden & Haag, 2016) that do not always represent real users. Hence, personas should be grounded in data collected through user research, although this alone does not guarantee equal attention to men's and women's needs. Stereotypes and inequality can emerge according to designers' own opinions about each gender's needs and designers' own biases towards a group. In discussing the improvement of personas in this research, relying on data from real users is considered inherent to the construction of personas.

Personas are usually constructed in early stages of the design process, when, after conducting research with users in the first stage, priorities and requirements are defined. When a UCD approach is adopted, users become the core of the project and every decision should be taken in line with users' needs. The creation of a set of personas is recommended in order to include different users into a single project (Cooper, Reimann, & Cronin, 2007; Pruitt & Adlin, 2006). When women's and men's needs differ and are equally important for the project, at least one persona of each gender should be created, to ensure that the "personas sufficiently represent the diversity of behaviours and needs in the real world" (Cooper et al., 2007, p.102). In the ideal scenario, designers would design with the two genders in mind and address their needs in a balance fashion.

In the design process, a persona guides decisions in each stage of it in order to ensure that the development is in accordance with users' expectations. Nevertheless, personas can carry stereotypes of gender and/or stimulate a design team to stereotype users (Wikberg-Nilsson, Källhammer, Fältholm, & Abrahamsson, 2010; Hill et al., 2017; Marsden & Haag, 2016; Cooper, 1999; Massanari, 2010; Turner & Turner, 2011; Källhammer & Wikberg-Nilsson, 2012). Personas should not depict stereotypes in order to inform differences of personality or lifestyle, just as real people do not (Pruitt & Grudin, 2003). As highlighted before, any envisioned user imagined by a designer leads to a script defining how the user should interact with artefacts (Akrich, 1992). The use of gender stereotypes, accordingly, may ascribe gender scripts to design (van Oost, 2003), which are facilitated by stereotyped personas. The use of a picture for a persona can increase the perception of stereotypes (Hill et al., 2017). Several studies have been carried out to shed light on gender inclusivity, gender stereotypes and gender biases in the use of personas. A study that proposed switching personas' genders in order to raise awareness of stereotypes revealed positive results with regard to the inclusion of women's needs and the detection of stereotypes in projects (Wikberg-Nilsson et al., 2010).

In a recent study, researchers proposed a set of personas called GenderMag to be used for evaluating problem-solving software. This method arose from a process entailing different experiments and discussions concerning the ideal solution for associating gender with a persona (Burnett, Peters, Hill, & Elarief, 2016). The authors created the GenderMag set of personas which is composed of two women and two men, although one woman and one man have the same personality, motivations, behaviours, and so on, and embody a mix of men's and women's traits that are not covered by the other two personalities. In a subsequent study (Hill et al., 2017), researchers proposed a different approach to tackling stereotypes issues that have emerged during the implementation of GenderMag – the use of multiple pictures in order to reduce the stereotyped perception of the pictures used to inform the persona that is a woman. In this multiple-pictures approach, the authors argue that

the multiplicity of stereotypes triggered by many pictures is a way to avoid focusing on any particular stereotype, and thus a strategy that allows designers to adopt a more inclusive practice.

The use of pictures to describe personas is considered to be an important aspect of their construction, as the addition of a face facilitates engagement (Pruitt & Adlin, 2006; Nielsen, Hansen, Stage, & Billestrup, 2015) and makes the character look more real (Grudin, 2006). Despite that, researchers on the GenderMag study realised that, after using the multiple pictures strategy, the persona's appearance was not important at all for participants' engagement with users since they spent very little time on the pictures - less than 2% of the total time spent analysing the persona description. The study did not test, however, whether participants would be able to engage with users in the same way should the persona be presented with no picture.

During user studies designed to investigate the effect of gender in the use of personas (Burnett et al., 2016), participants proposed the use of a non-gendered persona (a persona with no declared gender) and posed the question: "should the personas have a gender?". However, the researchers behind the study believed that gender was important to improving the "believability" of personas. That is, according to them, gender is important in order to make a persona look "more real". However, it is possible that omitting gender and pictures does not impede engagement with the persona, a hypothesis that was tested in the second study of this PhD thesis (see chapter 5), regardless of the presence of gender biases in design.

2.7 Neutrality, inclusivity, sensitivity: speaking gender

The use of the term "gender neutrality" in design has been considered problematic because it can recall the concept of "neutral technologies", in which an assumption of a "design for all" or for "everybody" is implicit (Rommès, 2006, 2014; Burnett, Churchill, & Lee, 2015). Neutral technologies are often considered neutral not because they merge the needs of a vast gender spectrum, but rather because gender is ignored (Churchill, 2010; Wajcman, 1991; Rommès, Bath, & Maass, 2012). For example, early voice recognition systems failed to recognise women's voices because an all-men team did not think about including women in the design and testing process (Churchill, 2010). The automatic sensors used to turn on lights in toilets serve as another example: a biased design based on the anthropometry of European and North American men fails to perceive a seated woman (Ramos & Rojas-Rajs, 2016), for the sensor was planned to reach those seated men only and the anthropometry of women was disregarded in the development process. Feminist scholars argue for accounting for different genders with inclusive practices based on more flexible gender identities (Bradley et al., 2015). However, the approach to gender inclusivity is, for several authors, a matter of removing the focus on gender in order to not reinforce gender dynamics (Cassell, 2002; Bath, 2014; Brigham & Introna, 2007). According to scholars in the field, neutral technologies are much more likely to be designed for the masculine norm (Oudshoorn et al., 2004; Wajcman, 2004; Rommès, 2014). Furthermore, neutrality in design is also connected to an ideal of "democratisation" of technologies by the inclusion of users, which cannot be really achieved since the design process encompass some many substantive choices (Berg, 1998). Thus, the word "neutrality" is not

problematic in itself, however, the context in which it has been used to describe technology led to a negative meaning.

Gender neutrality, however, is used very often in language studies to refer to gender-neutral pronouns. Unlike “science and technology”, this field seems to find a good use for the term “neutral” to explain pronouns that include, merge and expand the perception of gender in the attempt to reduce gender biases and to promote a spectrum of multiple gender identities. The idea behind neutral pronouns is to create a non-discriminatory common language to tackle the gender bias and sexism of a rigid binary system (Wayne, 2005). Because language has been an important tool to assign gender, it can also be a tool for challenging gender perceptions and achieving gender-equality (Sendén, Bäck, & Lindqvist, 2015). A study to measure the acceptance and adoption of the Swedish gender-neutral pronoun “hen”⁵ between 2012 and 2015 detected that the perception of the pronoun among the population changed from more than 50% negative perception in 2012 to almost 70% positive perception in 2015 (ibid.). Moreover, the first assessment showed that 50% of the participants in this study had never or seldom used a gender-neutral pronoun while three years later this number dropped to a half. Following this argument, the language of design could have a great impact in counteracting gender biases concurrently with the use of gender-sensitive tools. In this research the concept of neutrality used in language studies is adopted to refer to the construction of a neutral persona and a neutral scenario (see chapter 5), which rely on textual descriptions of the user and the context of use with the adoption of a neutral language.

In the “gender in design” literature, gender-sensitivity is often interchanged with gender-awareness and gender-inclusivity. Rommes (2006), for example, describe “gender sensitive design practices” as those that aim to “include” women. According to the glossary of the European Institute for Gender Equality (EIGE, 2018), gender awareness refers to the “ability to view society from the perspective of gender roles and understand how this has affected women’s needs in comparison to the needs of men” and gender sensitivity refers to the “aim of understanding and taking account of the societal and cultural factors involved in gender-based exclusion and discrimination in the most diverse spheres of public and private life”. In this sense, gender awareness should trigger reflection prior to the definition of methods, since without it no attempt would be made to use or create methods and tools that produce gender-sensitive practices and promote gender inclusivity in technological developments.

Its is worth mentioning that while the term gender-sensitivity is used in the literature to refer to practices in which gender is acknowledged, gender inclusivity is used to stress the “inclusion” of viewpoints and participation of both binary and non-binary people in the design process, as seen in HCI guidelines for gender equity and inclusivity (Scheuerman, Spiel, Haimson, Hamidi, & Branham, 2019), in the study of the effect of gender-inclusive design in websites (Metaxa-Kakavouli et al., 2018), and in research on gender-inclusive personas (Hill et al., 2017).

⁵The gender-neutral pronoun “hen” is a mix of the words “hon” (she) and “han” (he) in Swedish language and was included in The Swedish Academy Glossary in 2015.

2.8 The context of the user-mobile interaction: an analysis of the dating experience

The effects of gender in technology pervade each communication channel differently; however, it is impractical to analyse the impact of gender biases in the design of every technological development. To streamline the investigation, this research focuses on the impact of implicit gender bias in the design of mobile dating applications. For that purpose, it was crucial to understand the context in which online relationships are built and the social aspects that may produce a particular gender dynamic within this realm. The studies in the field supported the development of the design method used in the third study and, partially, in the fourth study of this research. Some gender issues pointed out by scholars in the “online dating” and “hookup” subsections (see Subsections 2.8.1 and 2.8.2 below), together with results of the first and second studies of this PhD (see Chapter 4), helped to identify those variables that impinge on the communication through ODS, which were crucial to the development of the method for analysing the impact of gender in the decision making processes of design and in constructing the personas employed during the last study (see chapter 6).

2.8.1 Online dating applications

The concept of online dating has arisen as a powerful and useful tool to engage people. Within the virtual realm, relationships are no longer restricted by chance, serendipity, space or even time, since users can connect to a great amount of people at a great distance range at the same time. However, the virtual environment has also been a space to stimulate sexist attitudes towards women. The first exploration conducted with women (see chapter 4) revealed that they felt frustrated during their experience of Tinder. The results indicate that the application not only disregards women’s needs and expectations but also exposes them to abusive situations. A similar perspective was brought forward in a study conducted by Churchill and Goodman (2008) revealed that in online dating apps, men tended to adopt a “scattergun” approach and tried to contact as many women as possible while women tended to be more selective. As a consequence, they would feel overwhelmed and leave feeling harassed, a dynamic that made no room for “good matches” to be seen and led to dissatisfaction with the service (ibid.).

In order to understand how design of the dating experience can be influenced by social beliefs, some assumptions are brought to light in this subsection, supported by literature, with the purpose of understanding the possible consequences of gender dynamics in ODS.

There are three circumstances that can contribute to the ODS experience described above: a patriarchal mindset, the anonymity of the virtual space, and men’s dominance in technology.

The patriarchal mindset, which characterises a way of thinking that prioritises men and their will, possibly underpins a social gender dynamic during interaction through ODS. This dynamic is connected to a historical power structure that results in the unequal treatment of individuals due to their gender. Men’s dominance,

perceived in many aspects of daily life, is the root of objectification of women and violence towards women (Hekma, 2008; Petersen & Hyde, 2010).

Considering gendered power relations, gender has implications beyond the problem of the division of labour between men and women: it places men in a superior position and women in a subordinate one (Hartmann, 1981). The cultural effects of the patriarchy are embedded in mainstream pornography (MacKinnon, 1987), prostitution and sexual slavery (Barry, 1984), sexual harassment and hostile sexism (Glick & Fiske, 1996), sexual assault on women (Fisher, Cullen, & Turner, 2000), and so on. The culture of violence towards women unfolds with an increasing risk of sexual victimisation in college and during young adulthood context (Fisher et al., 2000; Cranney, 2015), which is fostered through hookup culture (Hamilton & Armstrong, 2009; Flack Jr et al., 2007; Wade, 2017a) and ODS. In this sense, a sexist mindset which is still prevalent in society is very likely to be embedded in the design of information and communication technologies, and ODS.

The relative anonymity of Internet interactions facilitates possible partners in overcoming initial obstacles to traditional encounters (K. Y. McKenna, Green, & Gleason, 2002). As argued by Wajcman (2004, p.67), “cyberspace provides a risk-free environment where people can engage in the intimacy they both desire and fear”. In these kind of interactions, people feel more confident about self-disclosing and feel less fear of punishment and disapproval (K. Y. A. McKenna & Bargh, 2000). However, the risk-free environment opens up space for harmful virtual interactions, including cyberbullying, harassment and hostile sexism. The anonymity of the virtual space is a worsening factor for the manifestation of misogynistic thoughts, visible in movements such as the *#GamerGate*⁶ campaign (Massanari, 2017; Lin, 2017; Shepherd, Harvey, Jordan, Srauy, & Miltner, 2015) and *The Fappening*⁷ event (Massanari, 2017) or in online communities such as the “Men’s Rights Movement” (MRE), “Men Going Their Own Way” (MGTOW) or the “Red Pill” that oppose the ideal of gender equality (Lin, 2017). While people try to control the expression of their sexism during daily face-to-face interactions, they would rather feel free to express their sexist beliefs under the protection of virtual chats. Considering these aspects of virtual space and the occurrence of recent events, one can assume that people are more likely to adopt offensive behaviours during online interactions than in real life.

Men’s dominance in technology and the spread of sexist behaviour are intrinsically connected (Bruce & Lewis, 1990; Buckley, 1986). The underrepresentation of women in technology and science (Bruce & Lewis, 1990; Buckley, 1986; Cockburn, 1981; Fountain, 2000; Henwood, 1993; Keller, 1985; Wajcman, 2007) is the reason why the ideation and development of solutions to mobile phones are most likely biased in the beginning of the process. A unilateral perspective of men guides important project stages in which the problems, opportunities, motivations and approaches are defined. Considering that a mindset shaped by gender roles is ingrained in social behaviour, it is also likely to pervade every product and service designed by men. Without a balanced presence of women in the mobile device industry no equality can be guaranteed, and, women’s needs and expectations are very likely to be neglected.

⁶#GamerGate is an online campaign of hate towards gamer developers that are women.

⁷The leak of women celebrities’ personal pictures hacked from Apple’s iCloud service.

The belief that women are related to nature and subjectivity while men are related to mind and objectivity is behind the exclusion of women from the practice of science (Keller, 1985). Such social beliefs resulted in women's underrepresentation in technical occupations and the feminisation of lower level jobs (Henwood, 1993), as observed in the report mentioned earlier in this document which indicated that only 26% of computer science positions are held by women (Ashcraft et al., 2016). For this reason, it may be argued that computer science is an area dominated by men. Thus, as a consequence, technological developments are mainly designed by men and the solutions probably consider the perspective of men over the matter. The first experiment of this PhD (see chapter 4) showed that 85% of women users of Tinder believed that the developer of the app was a man. That is, they perceived a men's dominance in the application solution. The inclusion of women in the development process (as users and developers) would possibly reduce gender biases within technological products since women's needs and vision can be taken into account. Nonetheless, as highlighted before, there are still some barriers to leveraging women's input during in team discussions and participatory sessions.

2.8.2 Hookup culture, double standards and wellbeing consequences

In the last decade, hookup culture appeared as an alternative modality of sexual interaction with respect to dating and relationship formation. A hookup defines a casual and brief sexual encounter with no emotional ties, while romantic dating and intimate relationships reflect premarital steps towards a family constitution and are tied to the presence of emotional bonds. College campuses provide space for the spread of hookup culture (Allison & Risman, 2013; Armstrong, England, & Fogarty, 2012; Bogle, 2008; Fielder, Carey, & Carey, 2013; Fisher et al., 2000; Flack Jr et al., 2007; Hamilton & Armstrong, 2009; Kuperberg & Padgett, 2016; Wade, 2017a); as a period of experimentation supported by the dissemination of egalitarian ideas and acquisition of women's rights.

Research involving college students in the past decade reveals that young adults are gradually becoming more conscious of gender equality regarding pleasure and sexuality within intimate relationship (Petersen & Hyde, 2011), yet a double standard in hookups still carries gendered attitudes towards women's pleasure (Allison & Risman, 2013; Armstrong et al., 2012); that is, gender is a factor for "meriting orgasm" during casual encounters. Hite (1976) wrote about female sexuality and brought to light a shocking report regarding the lack of understanding of the female body, which exposed the power of taboo around female orgasm and the effects of the social beliefs over women's pleasure. Recent studies with college students reveal that both women and men are gaining knowledge of the physiology of the female body and orgasm over time; however, while on the one hand both women and men students reported that pleasure equity in intimate relationship is very important, on the other hand they comment that it is not expected that a woman orgasms during hookups (Armstrong et al., 2012). Such findings indicate the presence of sexist behaviours towards women during casual sexual encounters and the objectification of women, as they are seen as a providers of pleasure but have their own pleasure neglected. Moreover, despite the impact of feminism on sexual liberation and understanding of the female orgasm, men and women who engage in hookups are seen differently by the college students - men were far more likely to lose respect for women who hookup than for men (Allison & Risman, 2013; Bogle, 2008).

This reveals that the taboo around female sexuality is still pervasive in human interactions, and salient in casual encounters.

One longitudinal study on the moderating role of sociosexuality indicated that casual sex had no major effect on wellbeing and pointed to sociosexuality as predictor of authenticity (“feeling genuine and true to one’s self”) and enjoyment after casual sex encounters (Vrangalova & Ong, 2014). According to Vrangalova and Ong (ibid.) sociosexually unrestricted individuals were highly oriented towards casual sex and reported lower distress, higher self-esteem and emotional benefit after encounters than sociosexually restricted individuals. The study made use of the “sociosexual orientation inventory revised” (Penke & Asendorpf, 2008; Penke, 2013) to assess participants’ sociosexuality and measure their propensity towards casual sex. However, the study analyses only those individuals who had intercourse during the period observed and the same study confirms that individuals with high sociosexuality are more likely to be involved in casual sex. That is, the statistics concerning wellbeing in that study (Vrangalova & Ong, 2014) refer to those individuals who are less self-restricted and, consequently, are hooking up, since few sociosexually restricted participants engaged in casual sex and, consequently, reported its effects on their wellbeing. Hence, these results do not reflect the perspectives of those who opt out and does not disclose how the sexist behaviour affects women’s self-esteem in the long term with respect to the disregard of women’s pleasure in casual sexual encounters or the loss of respect within their social groups.

A different study with college students, however, revealed that hookup culture can threaten both men’s and women’s wellbeing when they feel socially pressured to participate in this sexual system but do not feel truly comfortable doing so (Wade, 2017a). A third of the American college students opt out of hooking up and only 15% of students report enjoying it, of which mostly are men, white, handsome, fit, wealthy and heterosexual (ibid.). These students fit into typically privileged positions within societal structure. That is, one is likely to benefit from hookup culture if one takes advantages, within the hierarchy of power, over disadvantaged groups. Moreover, hookup culture fosters and excuses behaviours that can lead to sexual assault and rape (Hamilton & Armstrong, 2009; Flack Jr et al., 2007; Wade, 2017a), stimulating violence against women, and, consequently, perpetuation of a social problem.

In this context, women in general prefer dating than hooking up (Bradshaw, Kahn, & Saville, 2010) since they are evidently looking for long-term relationships in which they can develop intimacy and find enjoyment and pleasure missing in casual sexual encounters (Wade, 2017b). However, they find themselves with few options and feel pressured to participate in such encounters with the hope that they can pass through that period and become someone’s girlfriend (ibid.). This hypothesis is confirmed in the first experiment of this PhD research, in which few women participants (out of 40) have openly stated that sex was a main motivation to use a dating application (Lopes & Vogel, 2017). However, these gender roles in sexuality are also stereotyped and shaped by social norms; if women have their pleasure neglected in casual encounters, are not well seen if they decide to hookup, and experience offensive behaviour in virtual environments, it can be difficult to differentiate preferences shaped by gender norms and frustrated experiences from genuine gender differences in the analysis of users’ preferences. A similar study based on interviews and qualitative exploration, revealed that men are looking for “respectable women” and disapprove of those who seem to have sexual experiences, who express

their sexuality, who were married or have children, and who are openly looking for partners (Žakelj, 2014). Another study brought to light that men are four times more likely to initiate conversations when dating online, showing how online relationship formation is based on traditional gender norms in which the initiator advantage reinforces gendered power relations (Kreager, Cavanagh, Yen, & Yu, 2014).

Under those circumstances in which the participation of women in ODS is shaped by men's norms, some threats to gender equity and women's wellbeing were brought to light: the disregard of women's perspectives in shaping technology disempowers them, harms their self-esteem and reinforces an unbalanced dynamic within products and services delivered by technology.

This research on gender effects on interactive interface design was built upon this intersection of hookup and online realms in order to investigate the impact of gender in shaping technologies and the existence of gender bias in the design process. For that reason, the frustrated experience of women users in ODS is the starting point of this research. This section provided an overview of research concerning ODS and hookup culture in order to support interpretation of the gender differences that emerged in the first study of this thesis. Moreover, the findings reported by other authors in this section support the development of a method for analysing gender bias, as described in Chapter 5, as well as the interpretation of results in all subsequent studies.

2.8.3 Online dating applications overview

There is a wide variety of dating apps available that offer unique experiences. Here, some of the most popular dating apps among heterosexual individuals are described. Tinder was selected for its popularity and as the first exploration of this thesis derived from feedback concerning this particular app. Informal discussion around the use of Tinder among women served as the original inspiration for this PhD research. It was beneficial to investigate an app that was popular, in order to facilitate the recruitment of participants and that provided men and women with the same options for interaction through the app, aligning with the goal of comparing experiences and identifying gender bias. Bumble is an app that is designed for women to enable a more pleasant experience for women, however, because it was designed with one gender in mind, it would not suit this initial investigation of gender bias. It is useful to describe the app however, as some of the issues that emerged with regard to gender dynamics in the analysis of Tinder are addressed by Bumble. Thus, Bumble could be seen as the most contemporary attempt to tackle some gender issues. The differentiation of gender within Bumble may seem controversial; however, it was beyond the scope of this PhD thesis to provide comparisons between apps and to elaborate upon apps other than Tinder.

Tinder: a popular dating app

Tinder is one of those applications that make it easier to connect people for their first contacts are established through a virtual space. Based on Tinder's last report (*Tinder's Report*, 2018), the application is being used in more than 190 countries, has made possible more than 30 billion matches so far, and facilitates 1 million dates per week. According to the company, the application is focused on bringing people together and promoting

connections that would not be possible outside the virtual realm. Tinder's graphical user interface is quite simple and clear, a combination that contributes to the popularity of the application (see Figure 2.2). It shows one person at a time and to see the next person the user must take a decision: to like or dislike the person viewed. Communication through Tinder has basically two steps. The first step involves choosing possible partners/friends. The idea of the manipulation is to be as simple as possible, and the interaction requires essentially three gestures (see Figure 2.3): the swipe left (dislike), the swipe right (like) and the swipe upwards (super like). The "super like" feature is limited in availability per day. When a user "super likes" someone they make their interest explicit, so the other part will know that the user is interested before they take an action (swiping right or left). Once one likes a person one needs to wait to see if that person reciprocates within the next hours or days (it depends on how often the other user goes online). Feedback is provided when there is a mutual match (except for super likes). Not matching can mean that the person does not reciprocate, but not necessarily. It can happen that the person did not see the profile because they do not go online often or do not spend much time swiping. The second and last step of the interaction is chatting. People may maintain some active conversations with their matches through the application's chat system. The evident appeal of the system interface derives in part from the reduction of personal risk in expressing unrequited attraction to an image of another person.



Figure 2.2: *Tinder's graphic user interface.*

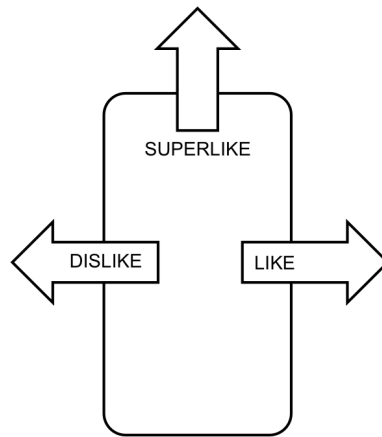


Figure 2.3: *Tinder's basic set of gestures to interact with the GUI.*

Happn: when proximity matters

Happn is another dating application used worldwide that uses location and proximity in order to suggest potential matches, therefore, it focuses on providing opportunities for interacting with people users have “crossed path” with. The GUI shows a scrollable grid with the people that were close to the user at some point of the day. It shows a map indicating where users were close to each other (within 250 meters) and also counts the amount of times it happened and where it happened (see Figure 2.4). It can be useful to identify people who attend the same places or live nearby. Users have the option to “like” those appealing to them, but unlike Tinder, they do not have to dislike those that do not seem appealing to them, although they are also provided with the “discard” option that would prevent the users that are not appealing from being continuously suggested by the interface. There is a “now” sign that appears in the user’s profile to indicate that they are nearby in that exact moment. Similarly to Tinder, users can only chat if they both like each other (when that happens users are notified with a “it’s a crush” message). For safety reasons, the app does not show the exact time users crossed path or the precise location of other users. Premium members who pay for extra features have the option to hide their ages, their last active date and distance. After users are displayed for each other, their distance is updated every time they move from one place to the other. However, there is an option to stop sharing crossing locations in the app preferences. Information on users is limited to name, age and profession. The application also lacks filters since it is only based on proximity.

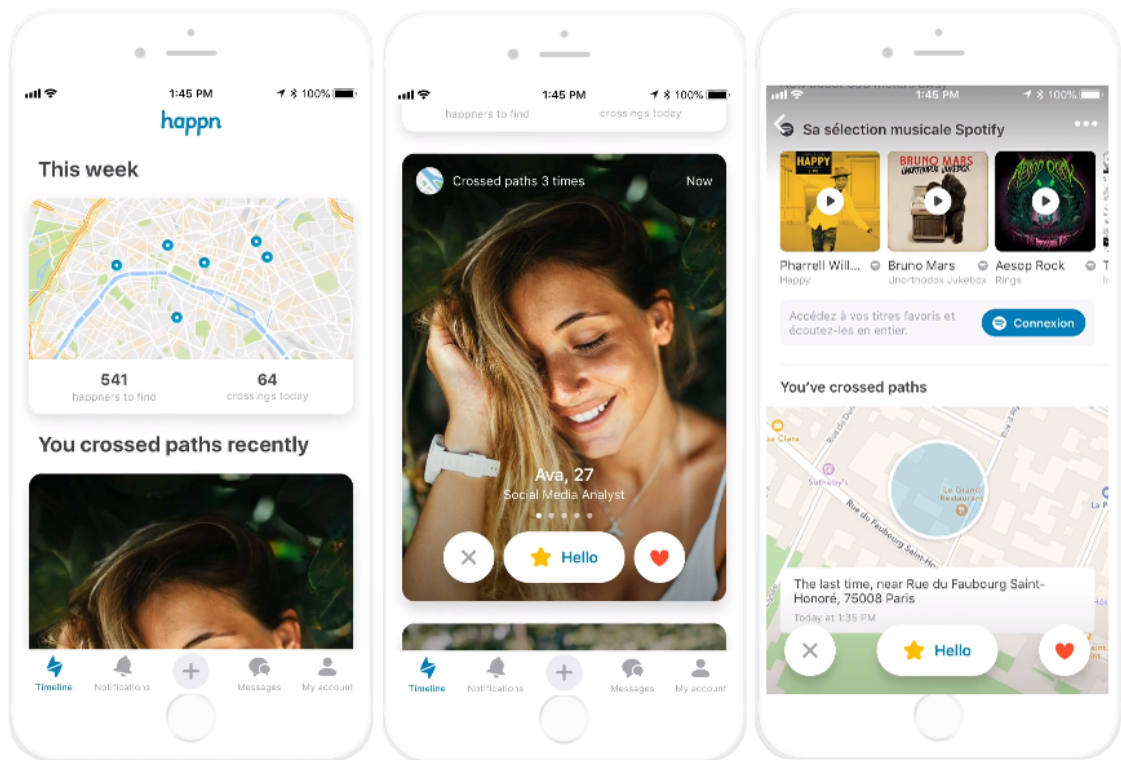


Figure 2.4: *Happn's graphic user interface.*

Bumble: women have control

Bumble is an app very similar in design to Tinder. It is mostly composed of the same gestures and steps (see Figure 2.5). However, in Bumble, only women can start a conversation. This strategy is used to promote the switch of gender roles with regard to conversation initiation and to prevent women from being overwhelmed by receiving unwanted messages. However, as in the other apps, users can only chat if they both like each other (when that happens users are notified with a “it’s a boom” message). Women have only 24 hours to initiate a conversation after matching; after that, the match is lost. Moreover, Bumble provides three distinct categories of interactions: “Bumbledate”, “Bumblebff”, and “Bumblebizz”. Bumbledate is used for finding partners for hookups or relationships, Bumblebff is used for finding friends, and Bumblebizz is used for connecting professionals for a business partnership. Bumble also provide voice message and video call embedded features. In Bumbledate users can filter by astrological sign, relationship type, family plans, height, exercise, education, smoking, drinking, pets, religion and political leaning. Users in Bumblebff can filter by interest, relationship status, parenting, smoking, drinking, pets, and exercise. User in Bumblebizz can filter by industry, networking type, years of experience, and education.

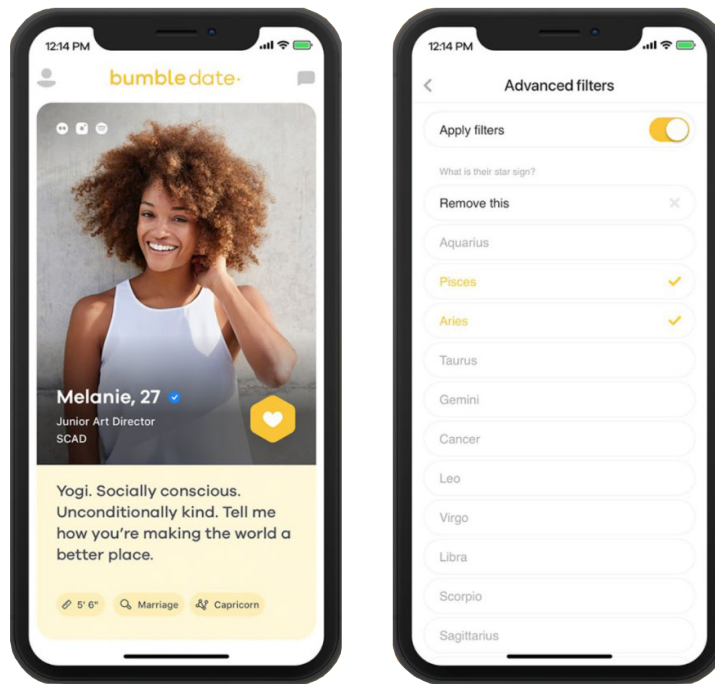


Figure 2.5: *Bumble's graphic user interface.*

2.9 Conclusion

The topics elaborated upon within this literature review bring a broad perspective on those themes that impinge upon the gendered experience of dating through mobile technology. To understand the design process and interaction design field it was crucial to analyse how gender biases can be implicit in the development of new experiences, in the early stages of a project. A better picture of how designers "think design" facilitates the development of methods to evaluate gender differences in design. Moreover, previous research concerning gender preferences supports the hypotheses developed here and reveals questions that have been left open to be addressed via this PhD research. This research, thus, was built upon the opportunities that emerge from gaps detected in understanding whether existing design tools are enough for addressing gender and whether the adaptation of useful tools can improve gender inclusivity. In addition to the design field in which communication is constructed, the sociological aspects of gender and relationship formation are approached to understand how ideas behind gender roles and historical gender dynamics affect the mobile application design process.

This PhD research expands the study of gender differences to the realm of mobile applications and focuses on the process of design as a mean to explore gender bias. As related before, mobile interactions fall under the interaction design field that produces a type of design shaped by mobile devices' features and developed with specific tools and guidelines to incorporate user needs. It seemed productive to identify gender biases in the design decisions that are taken in the early stages of design rather than exclusively through design outcomes and graphical elements. Moss and Colman (2001) analysed gendered aspects of design through its graphical elements in their study of business cards but to understand how gender is translated into graphic elements it was necessary to take a step back and analyse decision making during the establishment of requirements and

priorities in the design projects. Moreover, these design decisions directly elucidate the approaches, features, feelings and values chosen by designers - that would give a clearer picture of the subjective processes that trigger design choices - instead of only revealing the selection of design elements. Thus, this research takes a different approach to the studies described above since it is focused on the decision making process of defining requirements in design instead of analysing design outcomes.

Hence, considering the scenario where women feel free to benefit from technological advances in a world still influenced by gender hierarchies, this research evolves around the impact of gender biases in the development of mobile applications. Some possible causes and consequences of the biased implementation will be pointed out throughout this document, however, this investigation concentrates on the core question “How does gender affect the design of mobile applications and the user experience?”, which unfolds in four other questions:

1. Are there gender differences in the experience of dating applications?
2. Is design influenced by designers’ gender?
3. Is there a tendency to consider the user as a man?
4. Do gender-neutral tools improve gender inclusivity in the design of mobile applications?

In order to answer these questions, resulting in a novel research contribution, this investigation adopts a mixed methods design that employs both qualitative and quantitative data in order to measure gender differences and analyse these through statistical tests. In the next chapter, a more detailed explanation of the relationship between these research questions, the research structure, and a preview of the results are provided (see Chapter 4).

Chapter 3

Research methods

3.1 Introduction

The PhD research question emerged after the analysis of the results of the first group of participants (women users alone) in the first study, which served as the starting point of this research. In that study, in which 40 women users were interviewed, quantitative analysis revealed that a large number of women felt disrespected and frustrated using Tinder. An a-posteriori qualitative interpretation highlighted some probable causes for the resulting experience, producing this PhD research question: “How does gender affect the design of mobile applications and the user experience?”.

The understanding of men’s domination in technology and gender dynamics in relationship formation revealed in the literature review (see chapter 2) brought to light the hypothesis that women’s frustrating experience could be caused by gender bias in the design of the application, by other type of flaws in the app development (or in the mobile device system), or by social factors such as social beliefs that affect relationship formation. Flaws in development would result in inadequate human-device interaction for both men and women. Social factors, which also comprise social constructions of gender roles, influence personal biases in the design of applications. However, the social realm is not limited to gender dynamics since there are other social beliefs that can affect the experience of dating apps. For example, conservative or traditional communities can have specific manners or rituals regarding relationship formation or restrictions on dating and hookup culture, such as Hindu and Muslim societies, that could partially explain frustration in the experience of a dating app.

Three hypotheses for women’s frustration in dating applications are therefore enumerated below:

1. Gender bias in design: refers to the disregard of a gender group’s needs due to the influence of personal beliefs and preferences in decision making. The underrepresentation of a gender in design teams (Williams, 2014; Ashcraft et al., 2016), the lack of user research in the project (Williams, 2014; Portigal, 2008; Oudshoorn et al., 2004), and the presence of stereotypes in user definition (van Oost, 2003; Källhammer & Wikberg-Nilsson, 2012; Kuniavsky et al., 2012; Turner & Turner, 2011; Marsden & Haag, 2016; Portigal, 2008) make room for the influence of personal beliefs in decision making (Massanari, 2010; Akrich, 1995; Fleming & Koman, 1998;

Pruitt & Adlin, 2006; Mulder & Yaar, 2006). If this is the case, the needs of one gender group are likely to be prioritised over the others.

2. Flaws in development: causes issues for user-device interaction and, accordingly, in the human-human communication facilitated by mobile devices, due to negligence in the design process that impacts system and interface behaviour. This was defined as “technical bias” by Friedman and Nissenbaum (1996). Such neglect can occur in different stages of the design process; during user research, ideation, development, implementation, or validation with users, for example. Flaws in development affect users in general and are not related to one gender in particular;

3. Social factors: interfere in the adoption and use of applications due to religious or cultural beliefs and conventions. These factors are not identified during user research either because they are not part of the target user’s traits or because they come to light after use. This was defined as an “emergent bias” by Friedman and Nissenbaum (1996). For example, an application that was developed for one particular culture but is used worldwide is more likely to cause frustration due to cultural conflicts. Yet, internal conflicts can also emerge within the target group. Dating apps, for example, are seen as negative by many young people in democratic countries, due to religious beliefs, sexual taboos, or prejudice against hooking up. This affects users in general, but can also affect women more than other gender groups since many societies still hold traditional sexual double standards, for which men and women are differently judged for their experiences, openness and freedom regarding sex.

It is crucial to understand that these three causes of frustration are not independent. Social factors influence biases in design, yet social effects go beyond design and are not restricted to that. The probable causes for frustration are organised in these three assumptions for study purposes.

Given these three possible causes, this PhD focuses on gender bias in design as caused by the inscription of personal beliefs in the project. The assumption underpinning the central question of this PhD is that the designers’ gender can lead to different perceptions of the same matter and affect the decision making during the design process. Hence, this research is limited to understanding how gender affects the inscription of personal beliefs in the design of mobile applications. Other sources of gender bias (the underrepresentation of a gender in design teams, the lack of user research, and presence of stereotypes) have already been explored in-depth within the literature and will therefore not be the focus of this research. Those studies described in the literature review, however, do not answer whether gender biases would still occur when such issues are solved. For that purpose, a method was developed to investigate the effect of gender when women designers and men designers are presented with the same gender-neutral user representation grounded in data and gender-neutral application scenarios. This research presents an initial exploration to understand gender differences in the user experience of an application and, later, an exploration to understand gender bias in design.

This chapter explains the general research approach, the origination of the research question and sub-questions, how the studies were designed to answer these questions, and the relationship between the three studies. However, details of each study design, tools, participants, recruitment, and so on, are described in depth inside the chapter concerning that particular study. Thus, each study is outlined in a separate chapter with a full

description of the objective of the study, of the method for gathering and analysing data, of participants and recruitment, findings, discussion, and conclusions drawn. This organisational choice was made in order to make the content of this thesis more coherent, fluid and readable, given that it presents three unique studies, each with their own particularities.

3.2 Research questions

In order to investigate how gender impacts on the design of mobile applications, this PhD research builds upon the central research question below.

Central question: how does gender affect the design of mobile applications and the user experience?

This central research question, unfolds into four associated sub-questions, for which three following studies were designed:

Question 1. Are there gender differences in the experience of dating applications?

Question 2. Is design influenced by designers' gender?

Question 3. Is there a tendency to consider the user a man?

Question 4. Do gender-neutral personas promote the inclusion of women's and men's needs in a balanced way in design projects?

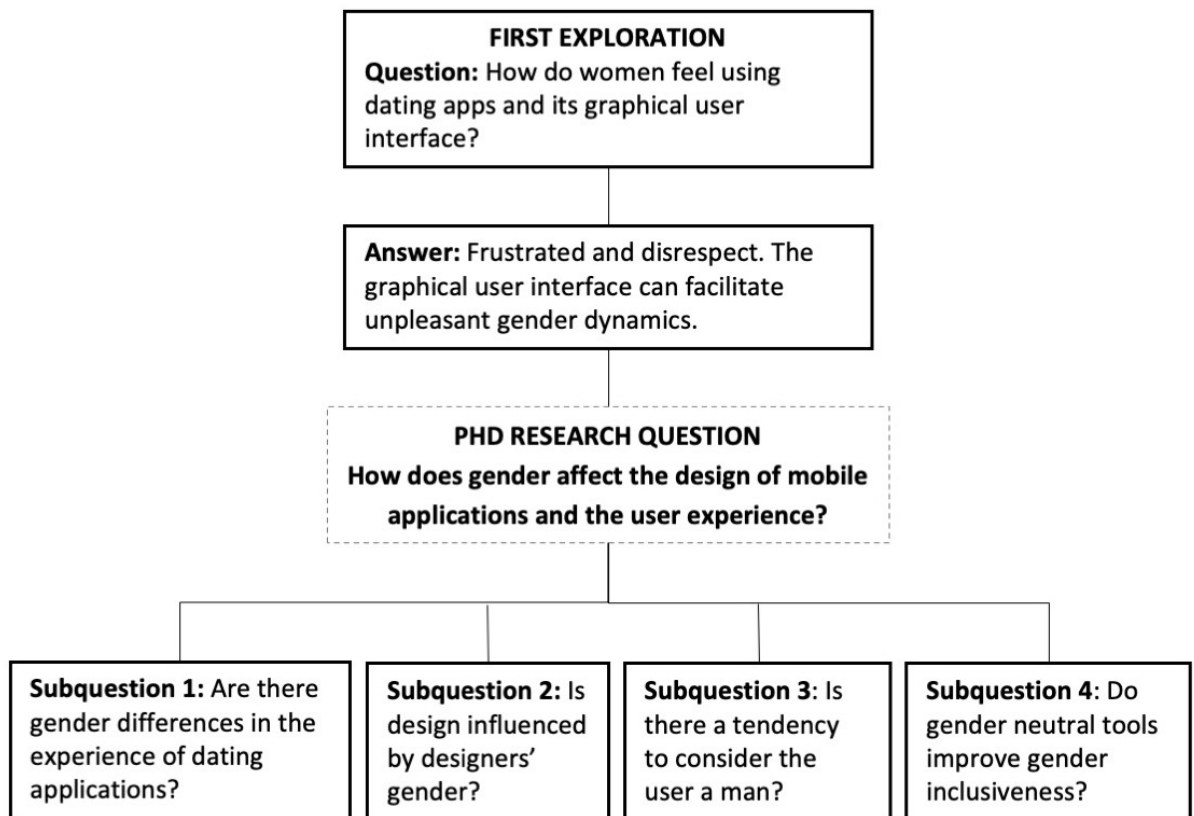


Figure 3.1: *Research flow: from first exploration to research questions.*

In order to answer this central question and understand whether gender biases in design affect the user experience of mobile applications, it was necessary to investigate whether there are differences between women's and men's experiences of a dating application. The first study provided an initial exploration to understand these differences. Should both groups report a similar experience, it would be possible to infer that the application frustrates users in general, and that the causes of frustration therefore do not necessarily depend on gender biases. Alternatively, should it be revealed that men and women have different perceptions of the application or report different concerns, gender bias in design remains a possible cause of frustration. Data collected in this first study was used to design the second study, with the intent of identifying gender biases in design.

The second study introduces a method for analysing gender bias in early stages of the design process. The second study was sufficient to answer the main research question; however, the third study goes further by testing the applicability of gender-neutral tools and providing an example of how gender inclusivity can be approached in design (see Figure 3.2). The results of this second study provided the means to explore the applicability of gender-neutral tools in the third study.

The third study, in turn, reveals whether the gender-neutral approach proposed in the second study promotes gender inclusivity and mitigates gender biases in the design of mobile applications. The third study aimed to answer a question that is left open in the second study but is not central to this PhD research, which concerns to the effect of neutral persona in design.

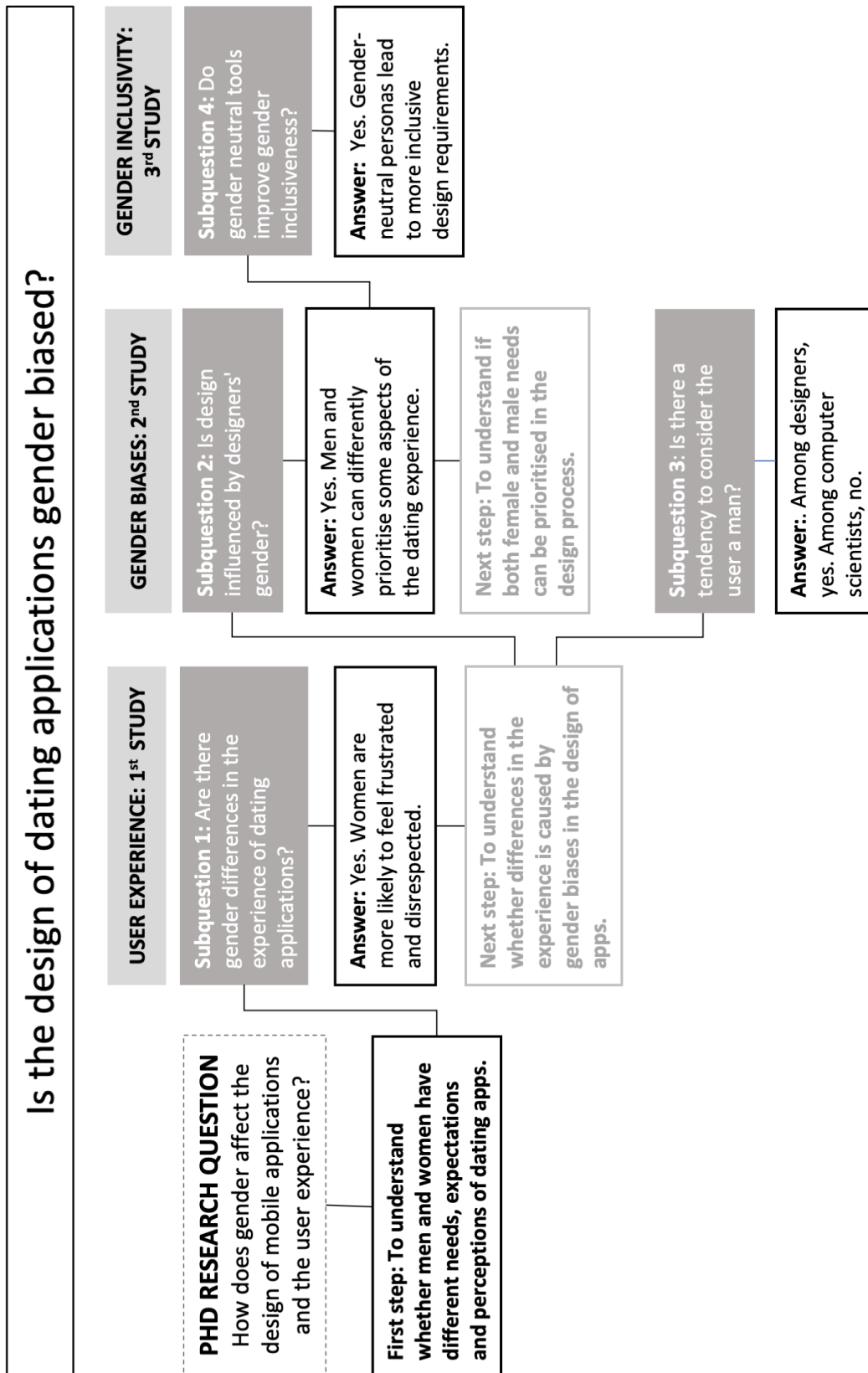


Figure 3.2: Research flow: Study flow through research sub-questions.

3.3 Research approach

Due to its exploratory character, this design investigation does not follow a single research philosophy and methodology but is underpinned by well-known perspectives and tools that support the proposed agenda. This

research presents a particular method to investigate gender biases in the design of mobile application. Methodological flexibility emerged as an important element in the exploration of the topic and for the development of a new method to investigate bias in design, as proposed and tested here. The creation of a new method, described in the second user study (see chapter 5), is not the primary goal of this research, but an essential part of it, and crucial for answering the research questions posed here. In order to find gender differences in the design process and in the assignment of gender to future users, the method developed involves the use of interaction design tools for defining requirements, the insertion of the concept of gender-neutrality into those tools and a set of tasks for conducting a user study. Critical realism (CR) as a research philosophy and grounded theory (GT) as a research methodology serve as the bases for the construction of this PhD research method with regard to the nature of the exploration, the research structure and the tools used in the investigation. However, the research method developed for this PhD presents a particular path towards answering the research question.

CR appeared later in the last century as an advancement of the philosophy of direct realism. Direct realism, also known as naïve realism, assumes that what people see is exactly what things are. The objectivism of natural sciences ontologically embraces direct realism, which epistemologically seeks to reveal the truth about social reality through measurable and observable facts. Through the perspective of objectivism, individuals and their experience of reality are considered to be independent and detachable from reality itself, which should be universal, solid and immutable. Moreover, under the axiology of direct realism, researchers should be able to produce a study free from biases. CR, as a mature development of realism, presents more flexibility regarding ontology, epistemology and axiology. The CR research philosophy focuses on explaining the human experience through multiple ontological layers, recognises the existence of invisible social mechanisms that are not directly observable instead of considering empirical data as conclusive of the reality, embraces a relativist epistemology, recognises that only a small part of reality is perceived and retained as empirical human knowledge which is historically situated and transient, and axiologically acknowledges biases due to cultural experiences and individual points of view (Bhaskar, 2010). That is, from a CR perspective, researchers draw upon theories in order to explain empirical data, which are not fully answered by the events of a graspable reality¹ (Archer et al., 2016).

In this sense, this PhD research is aligned with CR for it recognises the existence of gender dynamics deeply rooted in the construction of social interactions that could produce gender biases in design and, accordingly, the frustration of women users. Indeed, the discussion of causal mechanisms for the frustrated user experience is an important aspect of the interpretation of the findings of this research and it would be incomplete without it, since the effect of social gender dynamics motivated this research. Some critical realists also find it useful to explore the positive role of personal values in research (Donati & Archer, 2015), regardless of the commitment to approach neutrality and to minimise personal biases. It is also acknowledged in this research that the researcher's own experience leads to choices based on a personal point of view, but that personal biases should be neutralised (as much as possible) during the conduct of studies, choice of methods, and interpretation of the results.

¹The empirical data observed in the actual reality are explained by social causal mechanisms in the causal layer of reality.

GT is a methodology that supports the creation of theory based on data collected and analysed in a systematic way (Strauss & Corbin, 1994). In this process, research is not defined by hypotheses but instead draws upon constant exploration of data generated from measurable facts (Birks & Mills, 2015). One result leads to a new research question that leads to further explorations and results that lead to subsequent research questions, and so on. This methodology is initially underpinned by an inductive strategy of inference, in which data collection is usually used to explore a phenomenon and generate theories. In line with a GT methodology, this research begins with no pre-defined hypothesis in order to facilitate the identification of a research question with real-world significance. This research was subject to minimal planning in its initial stages, and theory did not guide the choice of the topic, which emerged after the identification of a major issue in women's experience of a dating application. The process of coding the data collected was not guided by existing theories, as suggested by GT, however, the method developed for investigating bias and the subsequent discussion of the results of each study are supported by theories described in the literature review of this thesis. Through design, sociology and HCI theories it was possible to understand the causal antecedents of women's experience, to define the research questions, and to select the methods and tools employed in each user study.

Some authors claim that GT does not fit with a CR perspective as the GT methodology and CR philosophy would approach the use of existing theories in different ways (Fletcher, 2017). In grounded theory, the development of new theories is based on data collected in-study and researchers should be committed to avoiding existing theories (Glaser & Strauss, 1967). That is, researchers should be cautious with the use of existing theories since it can bias the analysis of findings; the analytical process should be based on the data collected. CR also prioritises the conditional nature of data but acknowledges the fundamental role of theory in setting a particular question and defining the research plan (Bhaskar, 2014). However, some other authors argue that GT has evolved in different directions, accommodating flexibility with regard to pre-existing theoretical knowledge (Charmaz, 2006; Oliver, 2012; Redman-MacLaren & Mills, 2015) since Glaser and Strauss first designed the methodology (Glaser & Strauss, 1967). The disregard of researchers' previous knowledge of theory does not fit with a "realistic" philosophy; however this flexibility is claimed by the academic community which finds value in the use of a GT methodology in CR research. Moreover, with regard to the tension entailed in adopting a strategy of inference, most contemporary grounded theorists acknowledge the process by which induction leads to deduction in a back and forth process within the method (Glaser, 1998) and this shift from a purely inductive approach to one of abduction made room for taking pre-existing theories, hypotheses and even intuition as a valid starting point for research (Charmaz, 2006). As GT is a methodology for developing theories that relies on both qualitative and quantitative data (Adams, Lunt, & Cairns, 2008), it serves as a valuable foundation for the conduct of mixed method research.

This PhD research adopts a mixed methods approach that employs both qualitative and quantitative tools in order to explore the effect of gender in the design and experience of dating apps. A qualitative approach was essential for understanding both men's and women's perspectives on the experience of a dating application, which provided data regarding users' motivations, needs, expectations, frustrations, achievements, and so on. However, in the attempt to determine whether there was a difference between the two groups' perceptions, whether gender

biases occur or not, and whether gender-neutral tools improve inclusivity, an additional quantitative approach was also adopted. The quantitative approach enabled the analysis of measurable data as a means of quantifying the user experience, designers' decision making processes, and the implications of the use of a gender-neutral tool (persona) in design projects.

3.4 Tools

The tools used to answer the PhD research questions of this PhD are based on a mixed methods approach, that combines both quantitative and qualitative tools. The following tools were used to gather data in this research:

1. Semi-structured interview: in the first study a semi-structured interview was used in order to access online dating users' perceptions of their experience. The interview involved women users in a first phase and in the follow-up phase the same interview (with the same questions and ordering) was conducted with both men users and women users;

2. Design sessions: design sessions with users were carried out using a method developed for this study. Participants were assigned tasks to complete concerning decision making for a fictional application. They indicated answers through rating scales, ranked orderings and dichotomous questions;

3. Survey: data was also gathered through the use of online surveys² that presented dichotomous questions, multiple choice options, rating scales, and ranked orderings;

All studies were granted permission through Research Ethics Committee review at Trinity College Dublin. The first and second studies required a careful observation of responses with regard to indication of sexual abuse or any other crime. It was explained to participants that any disclosure on this matter would be reported to local authorities, in order to comply with the code of ethics. However, no participants disclosed a criminal act. In the third and fourth study, the main goal of the research was omitted from participants materials so as to not affect their responses, with the permission of the Research Ethics Committee. Nonetheless, a debriefing email with the results was offered to participants following all studies. All data provided by participants were anonymised.

3.5 Conclusion

The purpose of this research was to find out whether there exist gender biases in the design of applications or not. The third user study described above was designed to answer this central research question as a first step towards understanding the connection between gender and the process of design. In terms of the methodology adopted for this research project, two possible paths were considered, according to the outcome of the design sessions (see Figure 3.3).

²The online surveys in this PhD were designed and conducted through the Qualtrics platform.

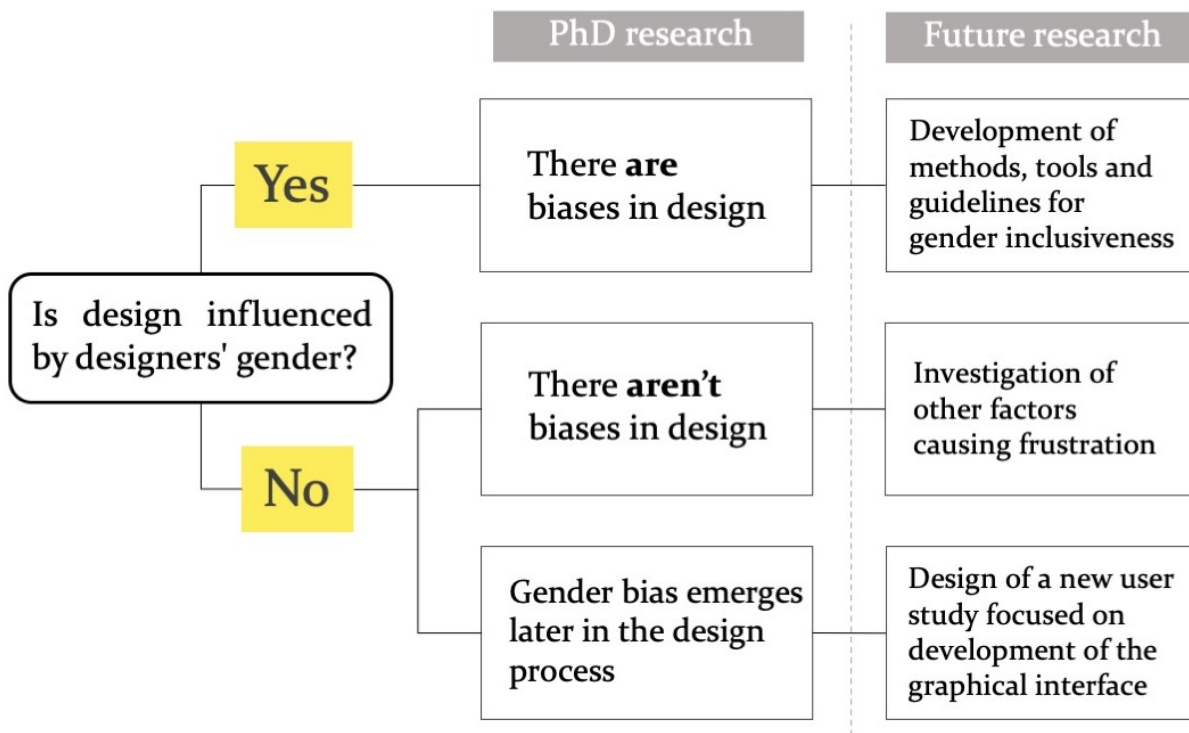


Figure 3.3: *Design bias study: outcome and future research.*

In the case of a positive result (gender biases exist), further studies could be designed in order to seek solutions to raise awareness of gender in the design process and to minimise gender biases in mobile application development. Indeed, the fourth study in this thesis is an example of such further explorations, in which gender inclusivity is approached through the use of neutral design tools.

In the case of a negative result (gender biases do not exist), some further studies were considered. It would be possible that gender biases do not arise in the first stages of the design process, where priorities are set according to users' needs, but it would also be necessary to consider that gender biases can occur in later stages. Furthermore, it would be appropriate to consider whether there are no gender biases in design and that gender issues revealed in the first study were caused by other factors (unrelated to the design process).

The third study revealed that there are gender differences in the process of design between women participants and men participants. Hence, the fourth study was carried out in order to reveal whether using gender-neutral tools would improve the inclusion of women's needs in the second stage of design, in which the priorities that guide further decisions in the design project are defined.

Each of the three studies' research methods and results are described and discussed separately in the next chapters. They are also discussed jointly in the "Integrated Discussion" - Chapter 7. In the Integrated discussion, the research flow described in this method chapter is revisited and analysed, together with theories highlighted as part of the literature review, in order to bring together the outcomes, constraints and future possible explorations of this PhD research.

Chapter 4

Study: users' experiences of Tinder

4.1 Introduction

Before investigating gender bias in the design process, it was necessary to explore users' perceptions of design solutions in order to understand whether gender biases affect their experience. A first study was carried out to investigate users' perceptions of online dating applications. The idea of this study emerged from informal observations and conversations with women about Tinder in general, not motivated by particularly feminist orientations. It was clear that they experienced contradictory feelings regarding the application—they indicated that they would encourage others to use it although they had an overall frustrating experience themselves; they would install and uninstall it multiple times; they would express directly opposing responses: some moments of total excitement (beautiful people, new matches, nice dialogues) and others of massive complaint (not attractive people, a lack of interaction, time-wasting, disrespectful approaches). From this observation of conflicting responses emerged the hypothesis that Tinder might not consider women's needs and might serve as a space for the reinforcement of sexist behaviour, which may be facilitated by the app and its GUI. The aesthetic of any interactive system carries instructions on how to use it (Petersen et al., 2004; Bannon & Bødker, 1989) and, consequently, is embedded with the designer's beliefs and perspectives concerning the system (Winograd, 1986).

The study is composed of two phases and two groups of participants. In phase 1, only women were recruited to participate. The initial idea was only to engage this first group, however, it seemed beneficial later to compare the experience of men and women. Thus, a new batch of participants including both men and women was recruited two years later. The exploration of phase 1 focused on determining problematic inscriptions of gender in the app through women's perceptions of the system. To streamline the investigation, three research objectives were established for the first stage. The first objective of this study was to learn women's perceptions of their experience of Tinder. The second objective was to investigate whether there were sexist patterns of behaviour during the Tinder experience. The third objective was to understand whether aspects of the interface design contribute to the establishment of an imbalanced gender dynamic. The exploration in phase 2 focused on determining whether there were differences in women's and men's experience of Tinder.

In order to understand how users felt using Tinder it was necessary to conduct a qualitative inquiry where the participants could describe their experience. Through this inquiry it was possible to obtain a panoramic view of their experience. Open-ended questions were posed without a preconceived notion of a comprehensive catalogue of response categories they would elicit. However, inspection and reflection on the responses revealed patterns for individual and across questions. The results enabled quantification, which revealed, for example, the experience of offensive behaviour related to gender dynamics as recounted by 70% of the participants in the first group (phase 1).

The findings of this study formed the starting point for this PhD research, through which a problem regarding gender dynamics was disclosed and implicated in consecutive studies (as combined in this thesis), which focused on explorations of gender differences in the experience of online dating applications (ODS), gender bias in the design of mobile apps, and the use of gender-inclusive tools in the design process.

The chapter is divided into two main sections: phase 1 (women alone) and phase 2 (men and women). The recruitment for phase 1 happened in April, 2016, and recruitment for phase 2 in September, 2018. The results of each phase are analysed and discussed separately. Notice that the discussion of phase 2 revisits some aspects of the discussion of phase 1, and an integrated discussion is additionally provided in Chapter 7.

4.2 Research design

In this first study, a mixed methods design was adopted, which enabled the incorporation of both qualitative and quantitative data (Creswell, 2014). Since the goal of this first study was to understand how users feel about the application, it was decided that the best way to assess perceptions would be through an interview, chosen for its exploratory nature. Recruitment was conducted via online social media and contact established by email. This study is considered qualitative in terms of the subject, the purpose of the study, and the technique used for collecting data (interview). The integration of a quantitative approach to the analysis of the findings helped to establish facts about the distribution of perspectives on a sensitive matter (the experience of an online dating application). The qualitative data and subjective analysis made it possible to understand the gaps, problems and frustrations through users' eyes. However, without a-posteriori qualitative analysis it would not be possible to judge whether there is a problem regarding the experience, whether there is a presence of sexism in interactions, and whether there are signs of gender bias in development. As this was first conducted as a qualitative research study whose results were later quantified in order to support qualitative findings, this may be characterised as exploratory sequential mixed methods research (Creswell, 2014).

4.2.1 Participants and recruitment

The sample was qualified as a non-probability convenience sample composed of individuals who used Tinder at least once to meet new people through the Internet. A non-probability sample refers to a sampling method in which not all the subjects of the population (Tinder users, in this case) get equal chances to participate since the

distribution occurs with the help of researchers' own networks. Anyone who saw the calls in both phase 1 and 2 could volunteer and every volunteer had the chance to be interviewed.

Despite the fact that the research was conducted in Trinity College Dublin, the sample in both phase 1 and 2 was mostly composed of Brazilian people. The sample was drawn from the population of Brazilian users most close to hand, for the researcher's network and channels of distributions were concentrated in Brazilian virtual groups. It is important to keep in mind that results may depict this particular cultural context for online dating in both phase 1 and phase 2 of this study. Age and education level were not taken into consideration in the selection of participants (participants were not asked to provide such information about themselves), nor was sexual orientation. However, in phase 1, one participant indicated that they were searching for homosexual interaction through their use of Tinder. As the idea in phase 1 was to understand how women feel on Tinder, it was decided not to exclude users looking for homosexual relations. During recruitment for phase 2, however, people searching for homosexual relationships exclusively were not included in order to compare the experiences of men and women. The number of participants looking for homosexual relations was not sufficient to support analysis of differences between the two groups using statistical tests and, accordingly, to elaborate on those groups' experiences in the discussion.

With regard to sample size, Sauro and Lewis (2012) argue that there is a misconception that sample sizes should be large in order to enable quantitative analysis and that even a sample of 10 participants can be quantitatively interpreted in user research. While the present study is not considered to be determinant in relation to the research questions that are addressed, it is believed that the small sample supports initial answers to the questions.

4.2.2 Structured interview

The research method involved data generation through the use of a structured interview with open-ended questions, text analysis of responses, the transformation of interview content into statistical data and the analysis of the results. A structured interview was considered the best option in order to maintain focus. The open-ended response approach enables the elicitation of different points of view around each question (Patton, 2002).

This study did not aim for a broad analysis of user experience on Tinder, per se; rather, the goal was to investigate particular points with regard to gender dynamics and perceptions of gender biases and gender differences in the experience of the app. The interview was conducted via email, with a set of standard questions intended to elicit open-ended reply and to invite further interaction, to which participants could respond asynchronously, at their leisure. This would ensure the maximal amount of reflection and also reduce demand characteristics (Rosenthal & Rosnow, 2009), along with other practical qualities of Internet mediated research (Hewson, Vogel, & Laurent, 2016).

The interview guide was meant to be brief, to encourage people to answer completely. The interview was planned to be as neutral as possible. . The questions were chosen based on the initial informal talks with women users that indicated some perceptions about gender dynamics and gender differences in the appreciation of

Tinder. Hence, the purpose of the questions is to investigate the engagement through the app, motivations, benefits, downsides, and perceptions of gender. The questions were posed to elicit ample information. The following questions were provided to each participant, in Brazilian Portuguese (see translation in the Appendix A), as a tool to collect data regarding their experience of Tinder. Below, the questions in English translation are provided and the motivations for each question are indicated.

Question 1 - Why did you install the application? What were you looking for and what were your expectations? This question was posed to understand the motivations for using Tinder.

Question 2 - Did you have to ponder before installing Tinder? Why? This question was posed to understand if there was any preconceived idea about Tinder and concerns that could discourage installation.

Question 3 - What was your first impression when you started using the app? The idea of this question was to find out what users felt about the application, before they had a complete experience of it. First impressions can reveal how the graphical user interface meets users' expectations.

Question 4 - How did you feel about your first matches? Via this question users were asked to recall the feeling they had when they first matched with someone using the application.

Question 5 - How did you feel about the application's approach and the match-based interaction? This question aimed to reveal what users thought about the interaction and the interface.

Question 6 - What are the positive aspects of your experience? Tell me about some remarkable situations. Through this question it was possible to learn about the perception of a "good" experience.

Question 7 - What are the negative aspects of your experience? Did anything unpleasant happen? Tell me about these situations. This is a key question that could reveal harmful dynamics in using Tinder.

Question 8 - Did you feel respected during your experience of Tinder? This question was posed to investigate whether Tinder creates a space for inconvenient patterns of interaction (including sexism).

Question 9 - For how long have you been using or have used the application? The duration of usage may indicate satisfaction or dissatisfaction.

Question 10 - Have you uninstalled Tinder? This question was posed to measure users' fidelity to the application as it can also indicate dissatisfaction to a high extent.

Question 11 - If you have stopped using the application, what is the reason? This question aimed to understand the reasons for dropout.

Question 12 - Do you think the developer was a man or a woman? This question was posed to reveal the perception of a gender dimension in the design of the application by users.

Question 13 - Do you see any difference between what men and women look for on Tinder? What do they look for, in general? This question was posed to elicit the perception of gender difference in relation to the motivation to use Tinder in order to understand how users' perceptions interact with their own aims.

Question 14 - Do you have friends that are using / have used the application? What is their opinion, in general? The idea of this question was to obtain insight into the users' peers with regard to Tinder.

Question 15 - How could your experience of Tinder be more pleasant? This question provided an opportunity to point out the improvements they wanted to see in the interface so they would have a better

experience. It could also reveal some of the problems regarding the interface, including those related to gender dynamics.

Question 16 - Have you used other dating apps? Which one do you prefer? Answers to this question would reveal how Tinder is positioned in users' preference rank and help to reflect whether there are better options for dating available.

4.2.3 Data organisation

Empirical analysis and careful interpretation of the responses characterises this qualitative approach to understanding women user's point of view and defines this first stage of the research project which is followed by a quantitative approach to handling data and interpreting it statistically.

To understand how users feel during their experience of Tinder is a purely qualitative process. However, it was necessary to analyse the responses quantitatively in order to judge whether the overall experience is pleasant or not, and whether the occurrence of gender bias was representative. Quantification of the responses helped to identify the percentage of women that gave similar answers to each question, which was key to judging whether Tinder was meeting those users' needs. Due to the design of the study, in which open-ended questions elicited broad and detailed written responses, the quantification of response was not possible with the raw data, but only through categorisation of the raw data.

This categorisation process involved iteratively summarising the interview responses, reducing paragraphs of reply to one or two sentences. The original fourteen questions were split into seventeen questions (since some of them had more than one constituent question) for the purposes of analysis. After repeatedly reading the interviews it was possible to develop an exhaustive (although not mutually exclusive, in that a single person's response may include more than one category) categorisation of answers. For example, the analysis of question No. 1 of phase 1, related to the motivation to use Tinder, resulted in six response categories that encompass all 40 answers. This process consisted in narrowing down the options each time, grouping similar motivations and reducing them to the minimum number of options in order to not have similar answers counted as two different answers. It was important to ensure the responses were well represented by the options, regardless of the number of responses in each category. For example, in question No. 1 of phase 1, one of the interviewees noted using Tinder to forget an ex-boyfriend. This response differed from all other categories. To maintain rigour regarding this classification it was not possible to infer that this respondent wanted to make friends or find a new relationship, and, thus, a category "other" was created for this sort of answer. Thus, six categories of responses emerged for that question, which were later reduced to words for statistical analysis. For example in question No. 1 of phase 1, a sentence like "I've installed the application because I was single and wanted to meet different people; I was looking for any kind of relationship, casual or not" could have been split into two categories "meet new people" and "find a relationship". However, by analysing the whole sentence, it was possible to infer that the motivation of this individual was to find some sort of relationship (short or long). It was not possible to infer that a purely sexual encounter was sought (although it could also have been the case).

Thus, to handle the data conveniently in a statistical analysis package (R), that description was reduced to the word “relationship”. Finally, it was necessary to check whether that group of categories of answers would really encompass all the answers. For this purpose, the raw interview texts were revised again to verify whether the answers for each question would be encompassed by those categories, and to certify that information was not lost in the process of reducing paragraphs to words or short sentences. Following this, it was possible to organise the interview answers in a spreadsheet that was used for calculations.

After this transformation of the raw interview responses in a coded data set it was possible to calculate the sum of the equal replies for each question using R. The answers for each question were reduced to words or short sentences (see Appendix B.1 and C.1). It was beneficial to use R to find correlations through cross-tabulations. Question No. 14 was not analysed since the answers included non-quantifiable data; information about users’ friends using Tinder were vague and did not reveal a consistent pattern.

4.2.4 Research ethics

The study was approved by the Research Ethics Committee of the department of Computer Science and Statistics at Trinity College Dublin. Participants were provided with the “information for participants” with the description of the research and terms of participation. They also received the “consent form” and had the option to agree or not with participating. Those who agreed received access to the interview questions. Data of those who completed the interview and submitted their answers was retained for analysis.

4.3 Phase 1: Women’s experience of Tinder

Despite the apparent safety provided by Internet, some concerns arise exactly from the ease of interaction. Since Tinder encourages relationships, first inside a virtual space and later, potentially, with physical interaction, it is relevant to understand the interaction in relation to gender issues and sexist patterns already established by society.

Behaviour patterns within the virtual realm may differ from embodied interactions: gender inequality can be intensified for people feel more confident to express their views at the distance supplied by virtual environments. In relation to this freedom, it is necessary to understand what freedom encompasses in gender relations since the virtual communities reproduce established social patterns and power dynamics (Wajcman, 2004).

This first phase of the study revealed that Tinder does not consider women’s needs, and that a high frequency of offensive behaviour towards women exists on the platform, that is possibly encouraged by the design of the application, since the choices made in terms of features, actions, and graphic elements can indicate how the user is supposed to behave, the level of freedom granted by the app and the consequences for their acts. Empirical analysis helped to reveal how gender dynamics were manifested through the GUI and which elements of the interface design contributed to the resulting experience.

4.3.1 Participants and recruitment

Recruitment for this study was conducted through Facebook. The first call for participants was posted in a closed Facebook group of Brazilian women living in Ireland. The group had 8,074 members at the time of recruitment (April, 2016). The call was posted once only in this group. The call described the research topic and what would be involved in participation. Women interested in participating in the survey were asked to leave a comment or an inbox message with their email address.

In total, 134 women expressed an interest in participating in this research. The information sheet for participants and consent form approved by the ethics committee was sent to them all (see Appendix D). However, not all responded providing consent and even fewer women subsequently responded to the interview having provided informed consent. Of the 134 total women that provided their email addresses, 40 were interviewed. Participation was voluntary, without remuneration.

This high drop-out rate could be attributed partly to the length of the information sheet and consent form necessary for proper ethical conduct. Attrition may also be partly attributed to the lack of immediacy in conducting interviews by email. Despite this, the interviewees were easily reached by email and, thus, the benefit of easily reaching participants and easily delivering the interview compensated for the drop-outs.

4.3.2 Findings

The results of the analysis of the interviews and statistical tests are described below. The results that are more relevant for the discussion are organised in tables in this section. For the complete listing of results of this study, see Appendix E.

Question No. 1 of the interview referred to the motivation for using the application (see Table 4.1). 60% of respondents pointed out that they were looking for friends or for meeting new people, among other interests; 40% were looking for relationship among other interests; 7% were looking for casual sex among other interests. Only 22% were exclusively interested in a relationship, and none of the 40 women was exclusively interested in sex. Because many interviewees were living abroad (in Ireland), 22% reported using the application for practicing language (English). In order to analyse whether the application met user expectations, it was helpful to understand users' motivations for adopting the application.

Question No. 2 referred to the need for reflection prior to installation. The idea was to understand whether there were concerns or preconceived ideas about the application. Of the total respondents, 64% did not report engaging in internal debate before installing it.

Question No. 3 referred to the first impressions using the application. Considering only those who answered the question (N=38), the most frequently expressed response (26% of respondents) was that the system was superficial. Considering all 38 responses to this item and dividing them into positive and negative feelings, it is possible to say that 53% had a negative first impression (since unfiltered refers to the lack of filters and sexualised refers to being too geared towards sex), while 47% had a positive first impression. For this question, only one response was considered for each interviewee – this analysis was possible because they did not

provide ambiguous responses with respect to positive and negative categories (as, for example, “confident” and “sexualised”); those who mentioned more than one feeling for the first impression concentrated it into the “negative” or “positive” feedback categories, but not both.

<i>Q1: Motivations for Tinder</i>	<i>Women (N=40)</i>	<i>%</i>
People/Friends	24	60
Relationship	16	40
Language	9	22
Curiosity	4	10
Sex	3	7
Other reasons	1	2

Table 4.1: Women’s motivations for using Tinder. Participants could point out more than one motivation, therefore the sum is not 100%. Every woman responded to this question (N=40); therefore none of them was absent.

Question No. 4 referred to participants feeling about their first matches. In relation to this, 84% of those who answered the question expressed feeling confident, 16% had a neutral reaction and none expressed a negative feeling.

With regard to the system approach (question No. 5), 18 women gave positive feedback saying that it enhances privacy (interaction is only possible when there is mutual interest), reciprocity (diminishing the risk of feeling rejected), is assertive, innovative or empowering. Eleven women gave negative feedback and said the experience was superficial. Four indicated that the system was superficial but also innovative, assertive, or enhanced privacy. Two said they had a neutral feeling about it. Thus, from the 35 women who answered the question, 52% gave positive feedback, 31%, negative and 17%, mixed or neutral feedback. The results of all feedbacks combined are shown in Table 4.2.

<i>Q5: Match system</i>	<i>Category</i>	<i>Women (N=35)</i>	<i>%</i>
Superficiality	Negative	15	43
Privacy	Positive	11	31
Reciprocity	Positive	5	14
Assertive	Positive	4	11
Innovative	Positive	3	9
Neutral	Neutral	2	6
Empowering	Positive	1	3

Table 4.2: Users’ impressions about the match system. Participants could point out more than one impression, therefore the sum is not 100%. 35 women responded to the question and five were absent.

Question No. 6 referred to the positive aspects of the experience of Tinder (see Table 4.3). 67% of those who answered reported meeting nice people and/or making good friends; meeting the expectation of the 60% who claimed to be interested in friendship in response to question No.1. Long or short-term relationships were found by 49%, even though only 40% originally expressed interest in establishing relationships through the system (see Table 4.1). 18% indicated they did not benefit from using the application.

Question No. 7 probed negative aspects of the application (see Table 4.4). Unpleasant experiences of a direct sexual approach were reported by 50%; 15% expressed being insulted by users and 15% experienced sexist remarks. A small but startling number (two users) reported being reprimanded by men who saw their

profiles on Tinder and felt free to say that it was not a place for them and they should not be using it. Both were living in their hometowns when it happened. For the majority recently living abroad that kind of situation is less likely since it should be harder to see known people on the application. In total, 28 women related an offensive experience regarding gender dynamics (see Table 4.5). This represents 70% of all interviewees.

<i>Q6: Positive aspects</i>	<i>Women (N=39)</i>	<i>%</i>
I've found friends	26	67
I've found partner(s) for a relationship	19	49
I had no gain	7	18
I've got tourist information	4	10
I've improved a language	3	8
I had fun	3	8
I've improved my self-esteem	2	5
I've felt empowered	1	3

Table 4.3: Positive aspects of using Tinder. Participants could point out more than one benefit, therefore the sum is more than 100%. 39 women responded to the question and one was absent.

<i>Q7: Negative aspects</i>	<i>Women (N=39)</i>	<i>%</i>
I felt harassed by direct sexual approach	20	51
I was insulted	6	15
I received sexist remarks	6	15
The application provides low interaction	5	13
The application lacks filter	3	8
There is no negative side	3	8
The application is superficial	3	8
Other	3	8
I was a victim of racism	2	5
I was reprimanded for using Tinder	2	5
The application is addictive	1	3

Table 4.4: Negative aspects of using Tinder. Participants could point out more than one motivation, therefore the sum is not 100%. 39 women responded to this question and one was absent.

<i>Q7: Report of offensive behaviour</i>	<i>Women (N=39)</i>	<i>%</i>
Reported offensive behaviour	28	72
Did not reported offensive behaviour	11	28

Table 4.5: Ratio of women who experienced at least one of these offensive behaviours: felt harassed by direct sexual approach, were insulted, reprimanded, a victim of sexism or a victim of racism.

From the answers about feeling respected or not during their experience (question No. 8; see Table 4.6), it was possible to define a spectrum ranging from “not at all” to “yes, completely” including the “yes and no” and the “mostly yes” or “mostly no” responses in the middle. The results showed that there was a very balanced number of women between positive and negative poles, but the majority fell in the middle where they would relate their experience as a mix of respectful and disrespectful moments.

Comparing the response pattern for question No. 8 with the results of question No. 7, it was revealed that among those 28 women who reported being offended, experiencing a direct sexual approach, receiving sexist or racist remarks, or being reprimanded by others for using Tinder, five still expressed feeling fully respected (see Table 4.7).

<i>Q8: Did you feel respected?</i>	<i>Women (N=40)</i>	<i>%</i>
Always	9	23
Often	5	13
Sometimes	12	30
Rarely	3	7
Never	11	27

Table 4.6: Feeling of respect during the experience of Tinder. Every participant responded to the question (N=40) and none was absent. Participants provided only one response.

		<i>Did you feel respected on Tinder?</i>					<i>Sum</i>
		<i>Always</i>	<i>Often</i>	<i>Sometimes</i>	<i>Rarely</i>	<i>Never</i>	
<i>Negative side of the experience</i>	<i>Sexual approach</i>	4	2	5	1	3	15
	<i>Offense</i>	1		1		1	3
	<i>Sexism</i>		1			1	2
	<i>Sexual approach + offense</i>				1	1	2
	<i>Sexism + sexual approach</i>			2			2
	<i>Sexism + racism</i>		1				1
	<i>Sexism + racism + offense</i>			1			1
	<i>Sexual approach + reprimand</i>				1		1
	<i>Reprimand</i>					1	1
	<i>Sum</i>	5	4	9	3	7	28

Table 4.7: Comparison by the feeling of respect during the experience on Tinder and the report of offensive behaviour among the 28 women who reported one or more types of offensive behaviour.

The application's engagement was measured by the time of use (question No. 9), and reason to uninstall (question No. 11, see Table 4.8). 49% of the 37 participants who answered the question used the application for less than six months; however, 32% used it for more than a year. From the original sample, 35 women uninstalled the application and, from those, 43% did so due to a new relationship and 43% due to frustration. 14% lost their interest in the application and 6% said they uninstalled Tinder because they were reprimanded by known people for using Tinder. Of 35 women, 20 (57%) uninstalled the application due to a negative experience (frustration, lack of interest or repression), two (6%) due to a mix of negative experience and the start of a relationship and 13 (37%) quit the application exclusively because they started a relationship. Hence, the 57% of women who uninstalled it exclusively for a negative experience represent the majority of the interviewees.

When women were asked whether Tinder was developed by a man or a woman (question No. 12), 85% of the 34 who responded suggested that the developer was a man (see Table 4.9).

<i>Q11: Why did you uninstall?</i>	<i>Women (N=35)</i>	<i>%</i>
I've started a relationship	15	43
I got frustrated	15	43
I got bored	5	14
I was reprimand by others	2	6

Table 4.8: Reasons to uninstall the application. 35 women responded to this question and 5 were absent. Women could point out more than one reason, therefore the sum is not 100%.

<i>Q12: Is the developer a man or a woman?</i>	<i>Women (N=34)</i>	<i>%</i>
Man	29	85
Both	4	12
Woman	1	3

Table 4.9: Developer's gender according to the interviewees. 34 women responded to the question, five had no opinion and one was absent.

When asked about the perception of differences regarding what men's and women's motivations in using Tinder (question No.13, see Table 4.10), 40% said they perceived no difference and 60% that men and women had different interests. Among those that reported perceiving a difference, 96% said that men were looking for casual sex, while 4% said that men were open to many things (relationship, casual sex, friendship). From the same 60% that reported perceiving a difference, 71% thought that women were in general looking for relationships while 29% believed women were open to many things.

Cross-tabulation between responses to question No. 1 and question No. 13 (see Table 4.11) shows that of people looking for heterosexual relationship and/or friends but not for casual sex (30 women), 20 women believed that men were generally looking for casual sex. Thus, 2/3 of the women who were only looking for relationships and/or friendship believed that men, in general, were not. They represent 50% of the total sample.

<i>Q13: Perceived difference of motivations</i>	<i>Women (N=40)</i>	<i>%</i>
Yes - A. Men look more for sex	23	57
Yes - B. Women look more for relationship	17	43
No - I see no difference	16	40

Table 4.10: Perceived difference of motivations. From the original sample (N=40), every woman responded to this question. The percentages in each column refer to the proportion of individuals of each gender who provided that answer. Participants provided only one response between 'yes' or 'no'. However, participants who answered 'yes' could indicate more than one reason (A, B or both).

		<i>Do you see any difference between what man and woman expect from using Tinder?</i>				Sum
		M: many things W: relationship	M: sex W: many things	M: sex W: relationship	No, they want the same	
<i>What was your motivation to use Tinder?</i>	relationship	0	1	4	4	9
	friends	1	1	5	1	8
	friends & language	0	4	1	2	7
	friends or relationship	0	0	4	2	6
	just curious	0	0	1	3	4
	friends or sex partners	0	1	0	2	3
	relationship or language	0	0	0	1	1
	practice language	0	0	0	1	1
	other reasons	0	0	1	0	1
Sum	1	7	16	16	40	

Table 4.11: Comparison by motivation to use Tinder (question No. 1) and the perception of gender differences with regard to motivation to use the app (question No. 13).

In response to question No. 15 (see Table 4.12), the interviewees suggested improvements that would provide them a better experience. The most rated improvement was the addition of filters, which was related to previous answers about first impressions and negative sides of the application.

When asked about other applications that the respondents had used for the same purpose (question No.16), more than half of the sample who answered (52%) had also used Happn and 36 % had used POF. The results also show that 36% of the respondents would prefer to use Tinder rather than other dating applications, and that Tinder was most often rated as the favourite among them. However, the sum of other preferred applications reveals that 48% would prefer applications other than Tinder. 16% did not express a preference.

<i>Q15: What was missing?</i>	<i>Women (N=37)</i>	<i>%</i>
Nothing	9	24
More filters	9	24
Better users	3	8
More interaction	3	8
Less expectation	2	5
Less hesitation	2	5
Find boyfriend	2	5
Chat improvement	1	3
Choose name/pics	1	3
Go back in choices	1	3
Less superficial	1	3
Limit time/likes	1	3
More patience	1	3

Table 4.12: Users' comments concerning what was missing in the experience of Tinder. 37 women responded to the question and three were absent. Women could point out more than one reason, and therefore the sum is not 100%

4.3.3 Discussion

Computer-mediated communication relies on the design of the interaction and on the GUI to communicate the purpose of an interactive system. However, these systems contain, apart from explicit meanings, implicit meanings which speak through design qualities (Moggridge, 2007). The aesthetics of design comprise the complex symbolic representations (Petersen et al., 2004) that represent social structures and beliefs.

Because our society has been developed to "afford" gender equality, users' perceptions regarding the interaction reveal not only their feelings but also the applications' affordances (Gibson, 1979), which encompass the design qualities (Norman, 1988). It is possible, for example, that the gender dynamic established on Tinder is encouraged by its graphical user interface and interaction design for women mostly perceived it as superficial when asked about their first impressions (Question No. 3), as well as the application's approach and the match-based interaction (Question No. 5).

Tinder provides a simple solution for the engagement of people through mobile devices. On one hand, it requires time to view profiles one by one, and this diminishes the effectiveness (but not the efficiency) of the application since users could reach more people (more effective, less time required) if they were all displayed in a scrollable grid view or list view instead (see Figure 4.1) as in the Happn app, for example. On the other hand, it may enable more matches since one does not know what comes next and users might tend to consider better what they have in view. Furthermore, considering the concept of classical conditioning (Rolls, 2007) where the body learns through repetition how to be rewarded, the matches would represent a positive reinforcer that would incite users to keep swiping to get more rewards. Tinder's graphical user interface also connotes a deck of cards, and that contributes to its fun and playful qualities, as noted by some users. However, for others, it can exacerbate the superficiality of the interface: choosing and discarding people.

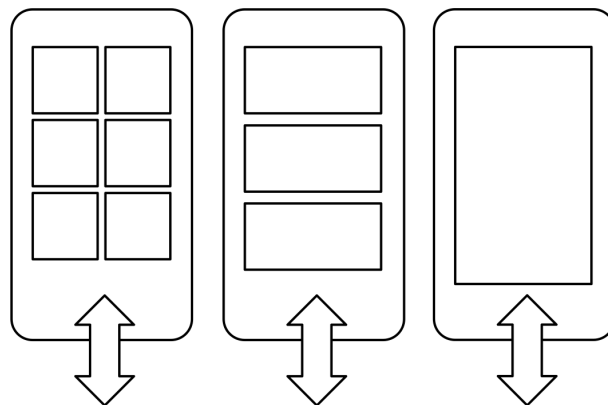


Figure 4.1: *Scrollable grid and list view options for displaying information on the screen.*

Regarding efficacy, as measured by a comparison between questions No. 1 (motivations) and No. 6 (benefits), Tinder appears to be efficacious in achieving women users' goals, especially in relation to making friends and finding partners for long-term-relationships, which were the most frequently mentioned interests among women.

In relation to "concerns" prior to installation (question No. 2), the results show that the majority felt free to use an online dating application and were not worried about consequences. This is a good sign that women are

interested in technological solutions for dating, and that there is a fertile field to explore regarding technological developments and online dating. Women (36%) who had to reflect before installing the app were mostly concerned about being recognised or were sceptical about this kind of approach, however they would still install it because they believed it was worth a try. It is possible to assume that some number of women gave up using the application for the same reasons these interviewees have pointed out in response to this question. This reflects a fear of being judged and the idea of hiding their sexuality as something to be ashamed of. Online dating applications can be useful for women to gain confidence about their sexuality, and this positive use of the Internet would be possible if mutual respect were provided.

Concerning first impressions (question No. 3), the majority (53%) expressed having a negative first impression of the application. The application match system was considered superficial by a relevant number of users in this research (38%), nonetheless, it enhanced privacy and reciprocity. Privacy and reciprocity, in turn, enhanced confidence.

Probably the superficiality of the Tinder experience does not inhere in the match system but in the whole interface which seems to be deemed excessively simple and based on appearances only. The “disposal of people” and the superficiality of a system based on appearance bring to light the concept of liquid love proposed by Bauman (Bauman, 2003). The liquidity of relationships refers to the ease of connecting and disconnecting that the Internet make possible. The boundless network and the uncountable possibilities built up a new crowd of self-propelled people who do not fear losing connections (Bauman, 2003). With the abundant availability of connections, it is simple to bond with people and even simpler to break up with them. A design focused on the positive act of “choosing” instead of “picking or discarding” would probably reduce the superficiality and maintain the “positive rewards” for the match system. Moreover, providing richer information about users and enabling different strategies for finding compatible people could also make the experience less superficial. “Meetup”¹ groups, for example, provide users the opportunity to find people with similar tastes in events organised through the platform.

The lack of filters (question No. 15) was one of the recurrent complaints related to superficiality which could be easily solved with more filter options, but especially with a filter of “interest” that would bring honesty and clarity to the user’s purposes. Superficiality may also be diminished if users could set their common visited places, tastes, and so on. For some people, even the user’s diet would count. Many users define it in their profiles, but there is no way to filter by “vegan” or “vegetarian”, by favourite artists, or by places that users like to go. Some users also said that some physical attributes such as height, that were decisive for them, should be explicit in profiles and possibly used as a filter. However, besides worsening the superficiality, this would be at odds with the promotion of diversity, and would incite the excluding standards of beauty which is also one of the aggravating factors in the objectification of women.

All these improvements to the profile and the possibility of filtering by interests would enhance users’ capacity to make use of their “personal front” which was first defined as the mix of appearance and manner that

¹Meetup is an online platform for organising events and forming groups of people with similar interests that want to meet outside the virtual environment - it doesn’t provide a virtual chat system, only events with different topics that users can join in person.

people use to present themselves to others (Goffman, 1959). However, through this virtual space, the personal front would be mostly defined by appearance and interests since Tinder does not have any audio or video features to support the “presentation of the self” by the time this research was conducted.

Despite the results of question No. 3, in response to which 53% reported a negative first impression of the system, women reported mostly feeling good about matching with someone, which could have compensated for negative first impressions, to some extent, and kept them interested in using the app for longer. Apart from the superficial “like-dislike” dynamic, Tinder’s interaction has some useful features to enhance self-esteem, which is noticeable in the 84% women who reported feeling confident after their first matches. The match system enhanced privacy and reciprocity, for users obtain only positive feedback from the application: Tinder indicates when two people reciprocally like each other. Furthermore, usually users would not remember their “likes” because there is no record of the people they liked. Users can only keep track of the people they have matched. This feature avoids the feeling of rejection and positively emphasises the successful numbers: the amount of matches. Additionally, the super like feature is also a boost of self-esteem considering that those who give it may not keep track of it but it possibly makes a positive difference to those who receive it.

Analysing the application and interview results, it is possible to make a link between the interface design and the sexist behaviour evidently experienced by participants in the study reported here. 70% of all interviewees reported offensive behaviour regarding gender dynamics and pointed it out as the worse side of their experience. The direct sexual approach was offensive for them in many ways. That is probably the worst aspect of the application that emerged in this study, since men seemed to feel free to drop the social norms of face-to-face conversations, revealing a hidden sexist mindset. As social dynamics speak through behaviour as well as through language (Blackman, 2008), this number gives a brief idea of how the sexist mindset is still determining social relations and reinforcing the gender dynamics that threaten women’s empowerment within relationship, family, labour and community realms. It is also a possibility that the norms of Tinder actively encourage the kinds of expression that would not normally be entertained during direct interaction.

Many of the expectations projected over women in relation to being “vulnerable” are set up during childhood² when “little innocent girls” may be “in danger” and should be protected from sexual abuse (Walkerdine, 1997). However, how is the idea of “vulnerability” treated in their adult lives, when they are “unprotected” by their families? In both moments women are taken as an object of an uncontrolled male sexuality, whose traces are still active behind the norms of behaviour, as shown by the results of this research. They are even considered dangerous due to the potential sex crimes they could incite (Walkerdine, 1997). This dynamic of predator-unsafe prey is exacerbated in online dating applications due to the perception of the Internet as a “free-zone” (Wajcman, 2004), where people feel more free to say what they would not dare to say in other circumstances (and real social contexts). That is the main concern about the application that emerges in this research. These gender dynamics can threaten women’s confidence (regarding their freedom and their sexuality, for example), block their empowerment process, reinforce the idea of women as sexual objects and make room for abusive/offensive behaviour.

²See, for example, “Little Red Riding Hood”.

Some positive approaches to interaction could make online dating applications also a space to spread gender equality through the concept of mutual respect. One possibility is that users could receive positive rewards and become more visible in the app when they develop respectful behaviour, which could depend at least partly on others' feedback (and possibly also in part on automatic classification of their within-system texts in relation to abusive or respectful language (Van Hee et al., 2015)). In association with the "positive reward" of increased visibility, users would be encouraged to develop good manners during their interactions through Tinder. Another possibility is that their good manners could depend not only on the other users' feedback, but also on a common effort towards mutuality. That is, positive ratings for behaviour would be possible if both users decide to help each other and only when both are committed to the rating system. If ratings could be visible only to the rated user, it would provide feedback about his/her behaviour and an indication that his or her profile would or would not be boosted as a reward. Such a concept of mutuality is successfully used in the Airbnb³ platform for exchanging reviews between hosts and guests: one can only have access to the feedback left for them if they also provide feedback. As an alternative to ratings, respectful behaviour could also be measured by the duration of the interaction or by the exchange of personal information (Facebook page, telephone number, email), and so on. Apart from the positive outcome of promoting good behaviour and rewards within the virtual space, this would also possibly enhance good behaviour in reality as a consequence of the classical conditioning inherent in the suggestion.

As a result of the improvement of behaviour, women would probably feel more respected during their experience, since the majority of women interviewed did not feel entirely respected (question No. 8), which should be a fundamental goal of online dating applications. An interesting fact that emerged in the cross tabulation between question No. 8 (feeling respected) and question No. 7 (negative side) is that some women (N=5) who reported disrespectful behaviour said they felt fully respected. This fact may suggest that some women grew used to that kind of behaviour and, despite disliking it (since they have pointed it out as a negative side of their experience) they do not feel disrespected.

The most frequent reasons for uninstalling due to frustration (question No. 11) show that it is very likely that the application does not meet women's expectations and needs. Motivations come from a natural desire to feel pleasure and avoid pain, but in order to engage people in the activity, it is necessary to sustain the pleasure (Calvo & Peters, 2014). Pleasure in a broad sense refers to social, emotional, physical or intellectual pleasure. Even if a relationship urge or a sex drive are the initial motivators, it would be necessary to improve users' satisfaction on different levels in order to engage them on Tinder. Regarding participants' overall feeling after use, it became clear that Tinder did not meet their needs in general, although it was efficient in delivering relationships and friendships. Of 35 women, 20 uninstalled the application due to a negative experience (frustration, loss of interest and negative feelings following disrespectful behaviours from men); two due a mix of negative experience and the start of a relationship; and 13 quit the application only because they started a relationship. The 57% who removed the application exclusively because of a negative experience constituted the majority of the interviewees. Furthermore, the answers regarding the developer's gender (question No. 12) revealed that 85% guessed it was a

³Airbnb is a platform for renting homes and rooms for short periods of time that is used worldwide.

man and, accordingly, that women perceived a men's dominance in technological development, which results in a design that meets men's interests and expectations.

In response to question No. 1 (motivations), 60% of the sample expressed interest in friendship and 40% were interested in relationships, but of this 40%, only half expressed exclusive interest in a relationship. That is, of the sample of 40 women only 22% were using the app exclusively for finding a partner. Conversely, of the same 40 women, 43% indicated that women are, in general, looking for a relationship (question No. 13). Furthermore, not a single woman said that women are in general looking for friends, while 60% commented that they were interested in friendship and/or meeting "new people" – the most frequent interest among them. The idea that women are looking for a relationship is probably a stereotyped notion of what women want. Because women also have that kind of stereotype deeply rooted in their reasoning, it seems relevant to take this into account in the planning of future user research. In the second study on gender bias on Tinder this effect is analysed through the ratings of relationship features, and the results of this first study are revisited in the discussion of Chapter 5. The perception that men are looking more for sex by the majority of women (N=23) is probably a consequence of the over sexualisation of the app, explicit in the experience of offensive behaviour.

Regarding the use of other online dating applications (question No. 16), Tinder was the best rated among them, however the majority still preferred to use other applications for the purpose. The Happn application was the second most highly rated and, according to this result, it would be the most relevant competitor for Tinder. The main differences between Happn and Tinder are: the grid view as already explained above, the proximity by GPS (since the users can only access people that they have crossed paths with), and a counter for the number of times the user crosses paths with those people. In this kind of interaction, details about venues and places frequented by both users provide more information than the interface based on appearance only.

Since 70% of women experienced harassment, 57% uninstalled the application due to a negative experience, 60% believed men and women generally have different interests in the application, and 85% believed the developer was a man, it is possible that the application was mostly developed for men's norm and may support sexual harassment. "Harassment" is arguably an over-used term and is correspondingly problematic as a conceptual notion. A recent study about sexual harassment (Bendixen & Kennair, 2017) tries to differentiate solicitation from derogation and argues that sometimes what victims perceive as sexual harassment is actually a solicitation act targeting short-term sexual encounters. However, because the purpose was to understand how women felt, users' opinions about feeling offended or not is what defines the use of the term in this study.

The results of this study reveal that Tinder is not meeting women's expectations and needs in relation to the application performance and that it has been a space for the replication of sexist patterns and the reinforcement of superficiality. It was possible to correlate the interaction dynamics with elements of the GUI that possibly support that kind of behaviour. Yet, Tinder was a useful tool to connect those users who answered the interview to friends and partners. To make mobile environments also a space for women's empowerment it would be necessary to involve women in the development of the interaction and interface, as users, as thinkers, and as developers, and to consider the use of strategies and tools that minimise gender bias in design.

4.3.4 Contributions, challenges, and constraints

This first study on gender and online dating applications was an exploratory step in the study of gender effects in mobile app development. A more detailed study of the experience of dating apps would require further development, nonetheless, such detailed investigation is not an objective of this PhD research. These findings support the hypothesis that Tinder harbours sexist behaviours and disregards women's needs, which is possibly caused by gender bias in development.

The challenge here was to bring out the expressions of gendered power relations in virtual social interactions and to transform the raw reports into categorised data that could be statistically handled and analysed. The whole process required many reviews of the raw data and the statistics. The repeated close readings were strategic in order to avoid bias during the process, since the intrinsic subjective analysis of the interviews that enabled the transformation of the paragraphs of answers into words is sensitive.

As this study included only 40 women, it is not possible to generalise the experience of Tinder, but the results were enough to support an investigation of gender bias in design and of gender-inclusive tools. These first results gave only an overall idea of the problems that affect the women's experience. Some standard potential critiques of the work must therefore be addressed at this point, most importantly: that there might be sampling bias, that the linguistic and cultural context may have influenced responses, and that the conduct of the study might have induced demand characteristics (Rosenthal, 1967). As participants volunteered to participate after a call and were not randomly selected from the population, it is possible that those women willing to participate wanted to share their experience because they felt they had something to add to the research. This fact enabled a more rich feedback but, at the same time, it does not ensure that the feedback from more engaged people reflects a rule for the user experience. It is worth to mention that participants probably felt they had something to add for different reasons, including either a very positive or a very negative experience. It must be acknowledged that the sample is limited, and future work would benefit by involving more participants in follow-up studies. Nationality is a variable that may interact with outlook on the topics studied here, and it may be beneficial to have a sample with mixed nationalities (not the case in this study). This, however, does not invalidate the conclusions reached here, as while they clearly do not generalise to all women (none of the responses were unanimous), if the conclusions are appropriate to a group of $N=40$ women, then they nearly certainly are appropriate to $N+1$ (and so on). A wider analysis of the user experience of dating apps would benefit from the use of other techniques such as focus groups, user tests, user diaries and empirical evaluation to deepen the understanding of the gender dynamics through the use of online dating applications. However, this first study gave the answers to the questions posed and were sufficient for this initial exploration that supported the research on the effects of gender in mobile app development.

The results of this study brought out some reflections about the gender dynamic established in online dating application that would enable future improvement of the system. Furthermore, it addressed design implications to thwart sexist behaviour and to improve women's experience. Besides the problems revealed by the research, Tinder appeared to be effective in delivering romantic relationships and friendship. Some boundaries are

mitigated through the application, enabling serendipitous engagements that address a positive quality to the use of technology in the realm of relationship. The results of this study indicate that the topic (gender bias) is appropriate and, therefore, should be better explored. The GUI, which provides guidance for the interaction, should be a consequence of gender-inclusive practices and could be a source for balancing gender in everyday interactions.

4.4 Phase 2: Gender differences on dating applications

The initial results (see Section 4.3) highlighted three facts that were important for the development of a wider research plan to investigate gender bias in mobile app development. First, the high percentage of reported allegedly sexist behaviour indicated the feasible presence of harmful dynamics among service users. Second, the high percentage of women who believed that the developer was a man sheds light on gender effects in the perception of design – if women believed the application was designed by men, they may be inclined to feel it was designed for men, more than for women. Third, the rate of overall dissatisfaction reported by women pointed to a problem regarding the design of the application that may be related to gender biases during the planning stages of the design of the online dating experience. The last two facts are very likely to be caused by gender biases in design, and, the first, could be either a consequence of design or worsened by design. Therefore, it is beneficial to know if both men and women have the same perceptions of the design and experience of dating apps.

It is safe to assume that sexist behaviours exist independently of Tinder and that women interacting with men outside of online dating applications also have negative (and positive) experiences. However, in presenting Tinder as an application that makes dating easier, one might imagine that its developers considered that it should provide an environment in which negative experiences are minimised rather than emphasised, relative to the alternative of not using such an application. One might imagine that its design attended to the perspective of both men and women in its development.

However, the initial exploration reported here left open the possibility that men have the same perception as women of the dynamics of online dating applications and may also be largely dissatisfied with their experience on Tinder. Moreover, the previous study identified women's perceptions of gender differences with regard to motivations to use the app, which can only be validated if men were included in the research and comparisons established through statistical testing. Therefore, a repetition of the study with subjects from both genders was proposed in order to examine differences of motivation, expectations, and perceived experience, and to gather evidence to indicate whether the application appears to prioritise the needs of one gender more than the other.

Although the findings of this second phase cannot be extended to the entire population of Tinder's users (not least because it did not report on the data of users seeking same sex matches), they revealed several differences that give a picture of the gender dimension of dating applications. Statistically significant differences were found with regard to the benefits and downsides of using the app and the feeling of respect. Analysis of the most frequent answers provided by each group (women and men) was used to design the personas and method of

the second study (see Chapter 5). The first phase of this study (see Section 4.3) addressed the views of women alone. This second phase considered the perspectives of both men and women, with an additional population sample and without pooling data from the first phase.

4.4.1 Participants and recruitment

In order to identify whether significant gender differences in the perception of the experience of Tinder existed, the same survey conducted with women was repeated in this second phase, this time involving both men and women. The method is identical to that used in the previous study (see Section 4.3). Specifically, the survey was conducted online (the questions are provided below), using Qualtrics instead of email, and posed the same questions as in the previous survey. As in the previous study, participants were again recruited through online social media, this time through WhatsApp groups in addition to Facebook, and did not exclusively engage Brazilians. As in phase 1, recruitment was not limited to Brazilians but, due to convenience sampling, did lead to more Brazilians participating.

Advantage was taken of personal relationships to distribute the survey. The call for participation was posted in personal Facebook and Whatsapp groups with a brief explanation of the study and the link to Qualtrics. Volunteers found the information for participants and consent form on the first page of the survey (see Appendix F). In total, 61 participants completed the interview. Of these, the data of 29 men users and 25 women users were used in the analysis. Participants were mostly Brazilian, with the exception of 7 men who were from European countries. Because there was no control over who had access to the Qualtrics link and anyone who used Tinder was invited to participate, there was no control for volunteers who also participated in Phase 1. All in all, the sample is qualified as a non-probability convenience sample composed of 54 heterosexual participants aged 20 to 52 years old who have used Tinder at least once to meet possible partners. Men looking exclusively for men and women looking exclusively for women (7 users in total) were excluded from the analysis. As the analysis was developed around the perception of gender and gender dynamics within the communication through online applications, primary attention was given to heterosexual individuals.

4.4.2 Results

The results of the analysis of the interviews and statistical tests are described below. The results that are more relevant for the discussion are organised in tables in this section. For the complete listing of results of this study, see Appendix G.

Examining Question No. 1, men and women recounted similar motivations for installing Tinder (see Table 4.13) with the exception of hooking up (casual dates and sex). No women openly said they were looking for sex and four men participants declared this to be the case. In both groups, participants declared they were looking for casual dates, which means they were interested in finding a casual partner for a short interaction involving sex or not, both with no emotional ties and no commitment, which characterises a hookup (Bogle, 2008; Wade, 2017). In total, 48% of men (N=14) reported that they were looking for hookups (sum of results for “sex” and

“casual”) while only 24% of women (N=6) said so. That is a substantial difference between the two groups, but only approaches statistical significance ($\chi^2 = 2.4318, df = 1, p = 0.1189$). Some categories are exclusive to one group or the other. For example, 12% of women said they were using Tinder as a pastime, while no man provided this reason. Apart from declaring hookups as a main purpose, men also said they were using the application to improve self-confidence, but no woman did so. None of the binary response categories yielded a significant interaction with gender; exact results are reported in Table 4.13.

<i>Q1: Motivations for Tinder</i>	<i>Women (N=25)</i>	<i>%</i>	<i>Men (N=29)</i>	<i>%</i>	<i>Total (N=54)</i>	<i>%</i>
Casual	6	24	10	34	16	30
Curiosity	4	16	5	17	9	17
Pastime	3	12	0	0	3	6
People/Friends	14	56	17	59	31	57
Romance	11	44	9	31	20	37
Self-confidence	0	0	2	7	2	4
Sex	0	0	4	14	4	7

Table 4.13: Motivations for using Tinder. Every participant responded to the question (N=54). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants could provide more than one response.

Question No. 2, which was about concerns before installing Tinder, revealed no considerable gender differences. Men were slightly more confident with respect to installation: 76% had no concerns prior to installation vs. 68% of women participants. This putative interaction between gender and reported need to reflect prior to installation of the application is not statistically significant.

In response to Question No. 3, men and women reported almost the same categories of answers regarding their first impressions of Tinder (see Table 4.14). Only one man, who expressed a neutral impression, said it was addictive, and one woman said the application seemed too sexual at first sight. The majority of women (58% of the 24 participants who responded to that question) had a negative first impression, whereas the majority of men (55%) had a positive first impression. The interaction between gender, and the categories of response is not statistically significant.

<i>Q3: First impression?</i>	<i>Category</i>	<i>Women (N=24)</i>	<i>%</i>	<i>Men (N=29)</i>	<i>%</i>	<i>Total (N=53)</i>	<i>%</i>
Addictive	Neutral	0	0	1	3	1	2
Awkward	Negative	1	4	3	10	4	8
Disappointing	Negative	4	17	2	7	6	11
Exciting	Positive	1	4	4	14	5	9
Fun	Positive	1	4	1	3	2	4
Great	Positive	6	25	7	24	13	25
Intuitive	Positive	1	4	2	7	3	6
Sexualised	Negative	1	4	0	0	1	2
Straightforward	Positive	1	4	1	3	2	4
Superficial	Negative	6	25	3	10	9	17
Unfiltered	Negative	2	8	4	14	6	11

Table 4.14: First impressions of Tinder. From the original sample (N=54), 24 women and 29 men responded to this question (53 participants in total). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants could provide more than one response.

With regard to their feelings about their first matches (Question No. 4), the results showed a subtle difference, although it is not statistically significant. The two groups produced the same categories of responses (confident,

indifferent, unrequited, uncomfortable), but several men also indicated feeling “unconfident” or “curious”. However, the categories “unrequited” and “uncomfortable” categories can also be considered as “unconfident”, considering that unconfident can either represent a feeling towards oneself or the application. Taking this into account, the majority of women (71%) felt confident while 25% felt unconfident. 55% of men felt confident and 31% unconfident. The interaction between gender and the categorisation of first matches is not statistically significant.

When asked about the design of the system (Question No. 5), the two groups provided similar categories of responses (effective, inefficient, fun, ok, straight-forward, superficial), except that men also introduced “reciprocal”, “easy”, and “confusing” responses, while women added “private” and “innovative” (see Table 4.15). Only 10% of men and 20% of women reported finding the system effective however. In total, 61% of women liked the system, 30% disliked it and 9% had mixed feelings. Among men, 52% liked Tinder, 41% disliked it and 7% had a mixed impression. The interaction between gender and impressions of the system is not statistically significant.

<i>Q5: Match system</i>	<i>Women (N=23)</i>	<i>%</i>	<i>Men (N=29)</i>	<i>%</i>	<i>Total (N=52)</i>	<i>%</i>
Confusing	0	0	2	7	2	4
Easy	0	0	2	7	2	4
Effective	5	22	3	10	8	15
Fun	1	4	2	7	3	6
Inefficient	5	22	6	21	11	21
Innovative	1	4	0	0	1	2
OK	7	30	7	24	14	27
Private	1	4	0	0	1	2
Straightforward	1	4	1	3	2	4
Superficial	4	17	6	21	10	19

Table 4.15: User’s impressions of the match system. From the original sample (N=54), 23 women and 29 men responded to this question (52 participants in total). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants could provide more than one response.

In response to Question No. 6 regarding the benefits of using Tinder, several gender differences came to light (see Table 4.16). Getting to know new people (and eventually making friends) was the aspect of the application most frequently rated positive by both groups (38% of men and 46% of women); although this difference is not statistically significant. For men, finding “an easy date” was also very compelling (35%), but only one woman also saw this as a benefit, and the difference is significant ($\chi^2 = 5.9265, df = 1, p = 0.01491$). Some 28% of women and 17% of men noted that starting a romantic relationship was a benefit; although the gender difference is not significant. Facilitating a “job interview”, practicing a “language” and the feeling of “empowerment” are benefits reported exclusively by women, while having “sex” and the opportunity to flirt “from home” are exclusive to men, but none of these categorisations are repeated in a manner that creates a statistically significant gender difference.

<i>Q6: Positive aspects</i>	<i>Women (N=24)</i>		<i>Men (N=29)</i>		<i>Total (N=53)</i>	
		%		%		%
Confidence	1	4	1	3	2	4
Dates	1	4	3	10	4	8
<i>Easy dates*</i>	1	4	10	35	11	21
Empowerment	2	8	0	0	2	4
Experience	3	13	2	7	5	9
Home use	0	0	3	10	3	6
Job interview	1	4	0	0	1	2
Language	1	4	0	0	1	2
None	3	12	2	7	5	9
Pastime	3	13	2	7	5	9
People / friends	11	46	11	38	22	42
Romance	7	29	5	17	12	22
Sex	0	0	1	3	1	2

Table 4.16: Positive aspects of Tinder for users. From the original sample (N=54), 24 women and 29 men responded to this question (53 participants in total). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants could indicate more than one response. Statistical significance using a chi-squared test of interaction between categorical variables is indicated by an italic font, and an asterisk (* - $p < 0.05$; ** - $p < 0.01$; *** - $p < 0.001$).

When asked about the negative aspects of Tinder (Question No. 7), some substantial gender differences emerged (see Table 4.17). One-third of women reported experiencing what they regarded as offensive behaviour towards them, while none of the men did so; this interaction between gender and reports of experiencing offensive behaviour is significant ($\chi^2 = 7.0127, df = 1, p = 0.008093$). One-fourth of women said that the application enabled interactions excessively focused on sex (“too sexual”), while only one man only expressed feeling bad about the “objectification” embedded in the system; the interaction between gender and the report of sexualised interactions is significant ($\chi^2 = 5.5885, df = 1, p = 0.01808$). 28% of men experienced unpleasant situations but only 12% of women commented that they did so; this difference is not statistically significant. Some response terms such as “prostitution”, “superficial”, “being ignored”, “few matches”, “features”, “frustration” and “unwanted sex” are exclusive to men, while “offensive behaviour”, “too sexual”, “feeling vulnerable”, “impersonal” and “rejection” are exclusive to women.

<i>Q7: Negative aspects</i>	<i>Women (N=25)</i>		<i>Men (N=29)</i>		<i>Total (N=54)</i>	
		%		%		%
Boring	5	20	9	31	13	24
Different information	6	24	5	17	12	22
Features	0	0	3	10	3	6
Frustrating	0	0	2	7	2	4
Ignored	0	0	1	3	1	2
Impersonal	1	4	0	0	1	2
Incompatible people	3	12	3	10	7	13
Objectification	0	0	1	3	1	2
<i>Offensive behaviour**</i>	7	28	0	0	7	13
Prostitution	0	0	1	3	1	2
Rejection	4	16	0	0	4	7
Superficial	0	0	3	10	3	6
Time consuming	1	4	2	7	3	6
<i>Too sexual*</i>	6	24	0	0	6	11
Unpleasant situation	3	12	8	28	11	20
Unwanted sex	0	0	1	3	1	2
Vulnerable	3	12	0	0	3	6

Table 4.17: Negative aspects of Tinder for users. Every participant responded to the question (N=54). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants could provide more than one response. Statistical significance using a chi-squared test of interaction between categorical variables is indicated by an italic font, and an asterisk (* - p<0.05; ** - p<0.01; *** - p<0.001).

Regarding the feeling of respect during the experience of Tinder (question No. 8), a significant difference emerged (see Table 4.18). 65% of men said they always felt respected while only 12% of women reported always feeling respected. 1/4 of women said they barely felt respected (12% never and 12% rarely) and another 1/4 of women felt respected only sometimes. 100% of men respondents reported always or often feeling respected. The interaction between gender and categories representing extent of experienced respect is significant ($\chi^2 = 23.469, df = 4, p = 0.000102$); inspecting Pearson residuals, it is evident that instances of women reporting always feeling respected is significantly lower ($p < 0.05$) and of men, significantly higher ($p < 0.05$) than one would expect if there was no interaction between gender and the perceptions of respect.

<i>Q8: Did you feel respected?</i>	<i>Women (N=25)</i>		<i>Men (N=29)</i>		<i>Total (N=54)</i>	
		%		%		%
<i>Always*</i>	3	12	19	66	22	41
Often	10	40	10	35	20	37
Sometimes	6	24	0	0	6	11
Rarely	3	12	0	0	3	6
Never	3	12	0	0	3	6

Table 4.18: Feeling of respect on Tinder. Every participant responded to the question (N=54). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants provided only one response. Statistical significance using a chi-squared test of interaction between categorical variables is indicated by an italic font, and an asterisk (* - p<0.05; ** - p<0.01; *** - p<0.001). Pearson residuals are highlighted similarly.

Another slight difference emerged with respect to the time of use of the application among participants (question No. 9). Among women, the majority used it for less than 1 year (68%), while among men the majority used it for more than 1 year (55%); the mean of months' usage among women is 9 and among men is 13. These differences are not statistically significant (neither using a chi-squared to test the interaction between gender and

the binary factor of months of usage less than 12, nor using a Wilcoxon test on the difference between the means of months of usage).

The majority of men (N=21) and women (N=21) participants had uninstalled Tinder (question No. 10). The majority of women uninstalled it due to a negative experience of the application (55%) while the majority of men uninstalled it because they started a new relationship (67%); however, this difference is not statistically significant. There are differences with respect to the reason for uninstalling the application (question 11), but they are not statistically significant (see Table 4.19). In both groups there are three main reasons: frustration, demotivation and the start of a relationship. 45% of women uninstalled the application because they started a new relationship and 55% due to a negative experience. 67% of men uninstalled it because they started a new relationship and 33% due to an overall negative experience of the application.

When asked about the gender of the developer (question No. 12), 72% of women reported to believe it was a man, 16% said they had no opinion and 12% said it was a woman. Among men, 59% reported to believe it was a man, 17% had no opinion, 10% said it was a woman, 7% said it was a team composed of both genders, and 7% said it did not matter. The interaction between gender and speculation regarding the gender of the developer is not statistically significant (see Table 4.20).

<i>Q11: Why did you uninstall?</i>	<i>Women (N=22)</i>		<i>Men (N=21)</i>		<i>Total (N=43)</i>	
		%		%		%
Blocked	1	5	0	0	1	2
Demotivated	5	23	4	19	9	21
Frustrated	5	23	3	14	8	19
Objectification	1	5	1	5	2	5
Relationship	10	45	14	67	24	56
Time consuming	2	9	1	5	3	7

Table 4.19: Reasons for uninstalling the application. From the original sample (N=54), 22 women and 21 men responded to this question (43 participants in total). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants could provide more than one answer.

<i>Q12: Is the developer a man or a woman?</i>	<i>Women (N=25)</i>		<i>Men (N=29)</i>		<i>Total (N=54)</i>	
		%		%		%
Both	0	0	2	7	2	4
Doesn't matter	0	0	2	7	2	4
Man	18	72	17	59	35	65
No opinion	4	16	5	17	9	17
Woman	3	12	3	10	6	11

Table 4.20: Developer's gender according to the interviewees. Every participant responded to the question (N=54). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants provided only one response.

In response to question No. 13, participants revealed whether they believed there was a difference between what women and men were looking for on Tinder in general (see Table 4.21). The majority of men said there was no difference (57%) while the majority of women perceived a difference (59%). The difference in response between the genders is not statistically significant. Those who thought there was a difference between the two groups pointed out (equally between men and women respondents) that usually men are more looking often for sex than women, or that women are more often looking for a relationship than men.

When asked what would make their experience better (question No. 15), both groups rated “accurate matching” most highly – 36% of women and 44% of men; the difference in reply by gender was not statistically significant (see Table 4.22). Apart from the improvements in common between the two groups, women also commented “block offensive behaviour”. Men noted “more matches”, “more women users”, “feedback”, and “women were more open”. Other responses were: “I don’t care”, “no”, “not sure”, “paid features”, “more interaction” and “more respect”.

In response to the last question (question No. 16), 80% of women respondents and 79% of men respondents said they also used other online dating applications apart from Tinder. In the women’s group, six said to prefer Tinder but only 13 expressed their preference. 21 men participants expressed their preference and 12 preferred Tinder. Thus, approximately half of the respondents in both groups prefer Tinder while the other half either prefer other applications or have no preference.

<i>Q13: Perceived difference of motivations</i>	<i>Women (N=22)</i>	<i>%</i>	<i>Men (N=28)</i>	<i>%</i>	<i>Total (N=50)</i>	<i>%</i>
A. Men look more for sex	12	55	10	36	22	44
B. Women look more for relationship	10	46	9	32	19	38
Total Yes	13	59	12	43	25	50
Total No	8	36	16	57	24	48
Total I don’t know	1	5	0	0	1	2

Table 4.21: Perceived difference of motivations. From the original sample (N=54), 22 women and 28 men responded to this question (50 participants in total). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants provided only one response; either ‘yes’, ‘no’ or ‘I don’t know’. However, participants who answered ‘yes’ could indicate more than one reason (A, B or both).

<i>Q15: What was missing?</i>	<i>Women (N=22)</i>	<i>%</i>	<i>Men (N=27)</i>	<i>%</i>	<i>Total (N=49)</i>	<i>%</i>
Accurate matching	8	36	12	44	20	41
Block offenses	3	14	0	0	3	6
I don’t care	1	5	1	4	2	4
More feedback	0	0	1	4	1	2
More women users	0	0	1	4	1	2
More interaction	1	5	2	7	3	6
More matches	0	0	1	4	1	2
More respect	2	9	1	4	3	6
Nothing	1	5	1	4	2	4
Not sure	6	27	6	22	12	24
Paying features	3	14	2	7	5	10
Women were more open	0	0	1	4	1	2

Table 4.22: Users’ report on what was missing in the experience of Tinder. From the original sample (N=54), 22 women and 27 men responded to this question (49 participants in total). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants could provide more than one answer.

4.4.3 Discussion

The survey results revealed gender differences with respect to a number of topics encompassed by ODS. The use of a mixed methods approach was key to identifying these differences. A quantitative analysis also made it possible to compare the two groups’ experiences. While the sample analysed is small, it is not so small as

to prohibit detection of statistically significant effects or trends approaching significance. The purpose of this research was to identify gender differences in response to the use of Tinder and to reflect upon the potential existence of bias in the design of the application. Here, the most relevant numbers are discussed.

The first difference concerns the motivation to use Tinder. Almost half of men said they used it for hooking up, while only a quarter of women used it for that purpose. Also, there was a slight difference in the desire to find a partner to develop a romantic relationship. Almost half of women said this was their aim in comparison to 31% of men. Thus, there is revealed a difference (although not statistically significant) in motivations to use Tinder, since men appear to look for hookups more than women. Women were probably less likely to look for hookups because they are more likely to have their pleasure neglected in this type of encounter (Armstrong et al., 2012; Allison & Risman, 2013; Wade, 2017b). This result reveals that, for women, Tinder is more a tool for social interaction while for men it is also a tool to find easy sexual interaction. Because 4% of men explicitly declared to be looking for sex, this also possibly indicates that men felt more free to declare that they were looking for sex while the lack of such a response within women's group can either indicate a taboo about openly reporting to be looking for sex or that women are less likely to have casual sex and one night stands. This result can also be a result of the loss of respect from the community that women face when hooking up (Allison & Risman, 2013; Bogle, 2008), which may have conditioned their search. If men and women were equally likely to seek casual sex, these results could suggest that women in this study were cautious about looking for casual sex through the use of an online dating application, possibly because they would be more exposed to sexual assault and rape (Hamilton & Armstrong, 2009; Flack Jr et al., 2007; Wade, 2017a).

Despite the taboo around female sexuality, results for question No. 2 show that women are gaining confidence to date online, since 68% of women participants expressed no concerns about using the application. However, 32% of women still had concerns prior to the installation of Tinder. Women's full comments indicated that they feared being recognised by known people, judged, exposed, rendered vulnerable, objectified or feeling ashamed. Many of these reasons, again, bear upon the loss of respect from people who judge women who are hooking up (Allison & Risman, 2013; Bogle, 2008). The main concern of the 24% of men who expressed a need to ponder possible consequences before installing the application referred to using an online application for flirting, which seemed odd to them. Hence, the answers for this item disclose a subjective difference between women's and men's groups with regard to concerns with online dating: while men's concerns are restricted to the oddity of using an application, women's concerns are related to their psychological integrity.

Differences also come to light regarding the benefits of using the application (question No. 6). In a similar fashion to participants' comments with respect to motivation (question No. 1), one third of men reported benefiting from "easy dates" (35%), while only one woman reported that benefit. Additionally, a greater number of women (29%) reported benefiting from starting a romantic relationship, in comparison to men (17%). However, more men (compared to women) reported uninstalling the application due to starting a romantic relationship. 31% of men declared looking for a relationship in response to question 1 and 67% of those who answered question No. 11 uninstalled the application due to a new relationship, but only 17% reported that as a benefit. These numbers possibly indicate that the application was not useful for relationship formation

among men and that they found their partners through “offline interaction”. Indeed, in response to question No. 7 (negative aspects of Tinder), 31% of users said the application was boring and 28% said they had experienced unpleasant situations. This is possibly the reason why “accurate matching” was by far the most frequently noted improvement suggested by men in response to question No. 15. Despite not receiving “good matches”, they still benefitted from casual sex. It also possible that some men were looking for a relationship, but preferred not to say so. In response to question No. 1, the number of men (67%) that engaged in a new relationship supports that assumption: it is possible that men are not conscious that they are looking for relationships, as if committed to certain stereotyped social roles (in line with which men should not be looking for romance).

Among women, “accurate matching” was also the most frequently desired improvement (question No. 11). Nevertheless, it seems women either did not benefit from hookups without accurate matching as men did or they did not really consider it a major benefit, even though 24% said they were looking for casual dates in response to question No. 1. For women, the most frequently reported negative aspect of their experience is “offensive behaviour” towards them: 32% of the group reported such an experience. The second most rated negative aspect was the perception of a “lack of accuracy” in profile information (28%), followed by the hyper-sexualization of interactions enabled by the application (24%). In total, 12 women (48%) reported unpleasant gender dynamics on the application (the sum of those women who experienced offensive behaviour, who felt it too sexual, and/or who felt vulnerable).

In response to question 8, only 12% of women said they felt always respected on Tinder, while 65% of men said so. Because almost half of women reported that they never, rarely or only sometimes felt respected, it is possible to assume that there is a gender factor dividing the experience of women and men. The vast majority of men were treated well while half of women were not. In fact, the majority of women uninstalled Tinder due to a negative experience (55%) through the application and the majority of men uninstalled it because they started a new relationship (67%). Men who uninstalled Tinder due to a relationship would possibly continue to use Tinder to benefit from hookups if they were single, even if lacking a “good match” or getting “bored”, since they are were likely to feel respected using Tinder and probably not exposed to psychologically harmful situations. Indeed, men are more likely to use Tinder for a longer time than women: the majority of women used it for less than one year (64%) and the majority of men for more than one year (55%).

The perception of the influence of gender in the design of the application (question No. 12) seems to be more evident for women users. 72% of women and 59% of men think the developer is a man. Both groups expressed awareness of men’s domination in technology, which is very likely to influence the application’s design (Williams, 2014; Oudshoorn et al., 2004). The numbers indicate that men’s needs were favoured in the design of Tinder. The spread of sexist behaviour is connected to men’s domination in technology (Bruce & Lewis, 1990; Buckley, 1986), which shapes technology from a unilateral point of view (Fountain, 2000; Wajcman, 2000). Because design is embedded with cultural values (Buckley, 1986) and designers’ beliefs (Winograd, 1986), technology is ingrained with a sexist mindset that excludes women (Wajcman, 2004). In ODS, the disregard of women creates space for the manifestation (and perpetuation) of sexist beliefs caused by gender bias in development.

Moreover, 57% of men commented that they don't think there is any difference between what men and women look for on Tinder (question No. 13), while only 32% of women think so. However, 41% of men and 52% of women perceived a difference. Although differences in motivations (question No. 1) only approach statistical significance (regarding hooking up), differences in the perception of the benefits of using Tinder reveal a significant disparity with regard to those users who ended up using it for hooking up (easy dates) and benefiting from that. The results to question No. 13 reflect a perception of gender neutrality by men, which encompasses the mistaken idea that a design solution is made for "everybody" to use (Rommes, 2006; Oudshoorn et al., 2004; Churchill, 2010). The application is, thus, considered by the majority of men participants as gender-neutral and, accordingly, gender is normalised – women and men are assumed to have the same patterns of behaviour and needs.

"Gender blindness" (Williams, 2014), in this case, is to consider that both men and women users have the same needs while using an online dating application. As pointed out before, women had concerns about being objectified, and feeling vulnerable or exposed, among others. Thus, their fears and hopes are part of their needs. If women did not feel fully respected, if they uninstalled Tinder due to negative experiences, if they sensed unpleasant gender dynamics in the application, among those other perceptions already mentioned, then the application is very likely to disregard women's needs and to be biased. The findings of this research reveal that a negative dynamic, one which disempowers women and reinforces harmful social beliefs, is very likely to be facilitated by Tinder. The application does not seem to fully meet men's needs either, although they are more likely to feel respected and less frustrated than women.

4.4.4 Contributions, challenges, and constraints

The results of this survey revealed differences between women and men regarding motivations, the feeling of being respected, the benefits of using Tinder and the downsides of the experience, among other components of the experience of an online dating application. Apart from highlighting these differences, a closer analysis brought to light how these differences are related to gender bias in the design of the application. Gender biases are more likely to occur when the design team is mainly composed in a manner in which one gender is in clear majority (Oudshoorn et al., 2004; Wajcman, 2004; Rommes, 2014), however, the presence of women in the team alone may not ensure that the design will be free from bias and that the needs of women will not be disregarded (Rommes, 2006). Apart from the inclusion of gender balance in technology design and user research, the commitment to using design approaches that focus on users' needs and to developing methodological tools to reduce biases are crucial.

The results disclosed here, however, are limited to a small sample of participants and cannot be extended to the whole population of Tinder users. Yet it is likely that a similar pattern should emerge from additional studies, using a larger sample of participants. Participants were mostly Brazilians and a cultural perception of dating and gender probably influenced the overall perception of the application and the experience of Tinder. A more mixed group could have revealed different gender dynamics. As in the first phase of the study, participants

who volunteered were possibly willing to share their experience since they were not randomly selected from the population; a fact that could have led to responses that fall on extreme opposites (very positive or very negative) of the user experience. Furthermore, it remains to explore how the issues studied here are experienced by homosexual users. It is an open question what additional categories of responses and response distributions will emerge where individuals seeking same-sex matches are more fully represented (but such investigation is beyond the scope of this PhD research). The gender dynamic reported here is analogous to that of the previous study in which only women took part. Regardless of the limitations of the sample, the figures presented by the survey draw attention to important issues in the development of mobile applications and important issues in initiating relationships in an online setting. Apart from quantifying the experience of Tinder users, another advantage of this study was in identifying categories of responses from both men and women, which is essential for understanding users' experiences. This understanding can be deepened through other quantitative studies, since users' preferences and the gender dynamics have already been described here. The focus of this analysis was on the quantitative aspects of the mixed methods approach; in order to elucidate gender differences in the experience of a dating app. Nevertheless, the subjective analysis can also be deepened using the data collected here.

4.5 Pooled data from women: phases 1 and 2

Data from women users in phase 1 and phase 2 of the study were compared to identify differences and similarities over time. The second phase of the study was carried out two years after the first. In order to understand how the experience of women developed over time, some of the original questions were selected, based on the weight of those questions to develop a rationale around women's perception of Tinder. In each of those questions only the most compelling categories of answers (those most frequent in both studies or important for the discussion) were analysed.

4.5.1 Results

With regard to the motivation to use Tinder, no statistically significant differences emerged by comparing the two groups (see Table 4.23). However, it is possible to note an increase in the numbers of women reporting hookups as a motivation to use Tinder in phase 2. The percentage of women that reported using the app for finding friends or partners for a relationship remained nearly the same.

Concerns about installing Tinder did not change over time (see Table 4.24). Women in both phases revealed that they were as likely to install the app. The percentage of women concerned about installing Tinder remained the same. The first impression they had of Tinder did not change either: the majority had a negative first impression in both groups (see Table 4.25).

With regard to the benefits of using Tinder, women in phase 2 were less likely to report finding friends or a partner as a benefit compared to women in phase 1; however, this difference is not statistically significant (see Table 4.26). The results for the negative aspects of their experience reveal a significant difference regarding the

experience of offensive behaviour (see Table 4.27): women in phase 2 were less likely to report feeling offended in comparison to women in phase 1. However, there are no statistically significant differences in the percentage of women who reported offenses, a sexualised interaction, or feeling boring; however the percentage of women who reported that the app is boring increased while the percentage for the other two categories dropped. Thus, the most significant change over time was the diminished reporting of being offended by the gender dynamic established in communication through Tinder.

Women in phase 2 were statistically more likely to report feeling "often" respected (see Table 4.28). Despite the lack of statistical significance, women in phase 2 were also less likely than women in phase 1 to report feeling completely respected but also less likely to report never feeling respected. Responses in phase tended to fall more within the intermediate categories of feeling respect than in the extreme categories (always and never).

No statistically significant differences emerged with regard to reasons to uninstall the application (see Table 4.29). The percentages for each category are nearly the same, with the majority of women in both phases uninstalling the application due to an overall negative experience. For the perception of differences in men's and women's motivations for using Tinder, no statistically significant differences emerged (see Table 4.30). The percentages for each category are very similar, with the majority of women noticing a difference and pointing out that men are looking for sex more than women.

The complete results of the chi-squared test conducted to compare the pooled data is provided in Figure H.1 in Appendix H.

<i>Q1: Motivations for Tinder</i>	<i>G1 (N=40)</i>	<i>%</i>	<i>G2 (N=25)</i>	<i>%</i>	<i>Total (N=65)</i>	<i>%</i>
Hookup	3	7	6	24	9	14
People/Friends	24	60	14	56	38	58
Romance	16	40	11	44	27	42

Table 4.23: Motivations for using Tinder. Every participant responded to the question (N=65). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants could provide more than one response.

<i>Q2: Concerns before installing?</i>	<i>G1 (N=39)</i>	<i>%</i>	<i>G2 (N=25)</i>	<i>%</i>	<i>Total (N=64)</i>	<i>%</i>
No	25	64	17	68	42	66
Yes	14	36	8	32	22	34

Table 4.24: Reflections before installing Tinder. From the original sample (N=65), 39 women in the first phase and 25 in the second phase responded to this question (64 participants in total). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants provided only one response.

<i>Q3: First impression?</i>	<i>G1 (N=38)</i>	<i>%</i>	<i>G2 (N=24)</i>	<i>%</i>	<i>Total (N=62)</i>	<i>%</i>
Total Negative	20	53	14	58	34	55
Total Positive	18	47	10	42	28	45

Table 4.25: First impressions of Tinder. From the original sample (N=65), 38 women in the first phase and 24 in the second phase responded to this question (62 participants in total). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants provided only one category of response.

<i>Q6: Positive aspects</i>	<i>G1 (N=39)</i>	<i>%</i>	<i>G2 (N=24)</i>	<i>%</i>	<i>Total (N=63)</i>	<i>%</i>
Hookup	0	0	1	4	1	2
People / friends	26	67	11	46	37	59
Romance	19	49	7	29	26	41

Table 4.26: Positive aspects of Tinder for users. From the original sample (N=65), 39 women in the first phase and 24 in the second phase responded to this question (63 participants in total). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants could indicate more than one answer.

<i>Q7: Negative aspects</i>	<i>G1 (N=39)</i>	<i>%</i>	<i>G2 (N=25)</i>	<i>%</i>	<i>Total (N=64)</i>	<i>%</i>
Boring	5	13	5	20	10	16
offenses	13	33	7	28	20	31
Too sexual	20	51	6	24	26	41
<i>Offensive behaviour**</i>	28	72	7	28	35	55

Table 4.27: Negative aspects of Tinder for users. From the original sample (N=65), 39 women in the first phase and 24 in the second phase responded to this question (64 participants in total). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants could provide more than one response. Statistical significance using a chi-squared test of interaction between categorical variables is indicated with an italic font, and an asterisk (* - $p < 0.05$; ** - $p < 0.01$; *** - $p < 0.001$).

<i>Q8: Did you feel respected?</i>	<i>G1 (N=40)</i>	<i>%</i>	<i>G2 (N=25)</i>	<i>%</i>	<i>Total (N=65)</i>	<i>%</i>
Always	9	23	3	12	12	18
<i>Often*</i>	5	13	10	40	15	23
Sometimes	12	30	6	24	18	28
Rarely	3	7	3	12	6	9
Never	11	27	3	12	14	22

Table 4.28: Feeling of respect on Tinder. Every participant responded to the question (N=65). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants provided only one response. Statistical significance using a chi-squared test of interaction between categorical variables is indicated with an italic font, and an asterisk (* - $p < 0.05$; ** - $p < 0.01$; *** - $p < 0.001$).

<i>Q11: Why did you uninstall?</i>	<i>G1 (N=35)</i>	<i>%</i>	<i>G2 (N=22)</i>	<i>%</i>	<i>Total (N=57)</i>	<i>%</i>
Relationship	13	37	10	45	23	40
Negative	20	57	12	55	32	56
Mix of the two	2	6	0	0	2	4

Table 4.29: Reasons for uninstalling the application. From the original sample (N=65), 35 women in the first phase and 22 in the second phase responded to this question (57 participants in total). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants provided only one response.

<i>Q13: Perceived difference of motivations</i>	<i>G1 (N=40)</i>	<i>%</i>	<i>G2 (N=22)</i>	<i>%</i>	<i>Total (N=62)</i>	<i>%</i>
A. Men look more for sex	23	57	12	55	35	56
B. Women look more for relationship	17	43	10	46	27	44
Total Yes	24	60	13	59	37	60
Total No	16	40	8	36	24	39

Table 4.30: Perceived difference of motivations. From the original sample (N=65), 40 women in the first phase and 22 in the second phase responded to this question (62 participants in total). The percentages in each column refer to the proportion of individuals of each gender who provided the response. Participants provided only one response; either 'yes' or 'no'. However, participants who answered 'yes' could indicate more than one reason (A, B or both).

4.5.2 Discussion

The results of the analysis of the main questions and categories of answers that emerged in the two phases of this study with women users of Tinder reveal that their perception of the application did not change over time, with few exceptions. Women were less likely to report offensive behaviour as a downside of the app and more likely to report feeling “often” respected.

These findings may be explained either by the emergence of more respectful interactions on the app or by women being less likely to report feeling offended having gotten used to the gender dynamic established on Tinder. The number of offenses did not change but the percentage of women who reported finding the app too sexual dropped to half from phase 1 to phase 2. Since the app did not change in those two years, it is possible that women in phase 1 felt more surprised about the sexualisation of the communication through Tinder and women who engaged with the application two years later knew better what to expect, for the application and its reputation also became more popular over time. Women in phase 2 were more likely to report the feeling of respect in line with intermediate categories of response (often, sometimes, rarely) than with the extremes (always, never). This can also indicate that women knew better what to expect of the app; they may not feel completely respected but are less likely to feel disrespected. The feeling of respect for women in phase 1 was spread across the categories of “always”, “sometimes”, and “never” while in phase 2 was concentrated around “often” and “sometimes”. If the gender dynamic through Tinder evolved to embrace more respectful interactions, this would directly impact women’s feelings of respect and impressions of the sexualisation of the app.

In addition to the statistically significant differences, some trends could be identified. Women were more likely to report being in search of hookups in phase 2. Women in phase 2 possibly felt more comfortable about dating online and having casual dates than women in phase 1, who were interviewed two years before the second group.

Women in phase 2 were less likely to report making friends or finding a partner through the app as a benefit. Despite the fact that connecting to potential friends and partners are the main motivations for women in both phase 1 and 2, it is possible that the application became less useful for those purposes from one phase to the other.

4.6 Conclusion

The objective of the exploration conducted in phase 1 was to understand how women felt using Tinder. It was possible to identify that Tinder does not provide an overall pleasant experience for women, since all the results point to a feeling of frustration: including first impressions of the application, the analysis of negative experiences, the feeling of respect, the comparison between users’ motivations and the perception of differences in motivations between men and women, and reasons to uninstall Tinder. Furthermore, the results about the negative side of their experience, including the feeling that the app was designed by a man, the majority of respondents’ sense of not being mostly or fully respected, and concerns about installing Tinder due to its sexual

approach and negative reputation, indicate gender bias on Tinder. Patterns of response suggesting that Tinder's GUI and interaction encourage negative experiences were also noted: the GUI encourages the discarding of people and reinforces superficiality; the gesture set is merely binary, leaving no way to express nuance; and so on.

Phase 1 of the study left open the possibility that men could also have a similar experience of Tinder, and that therefore the sense of being disrespected, offended, and frustrated may not be caused by gender bias in development, and not be exclusive to women. A follow-up study including men made it possible to understand gender differences with regard to the perception of Tinder and detect divergence in users' needs and experiences. Phase 2 involving men revealed statistically significant gender differences with regard to the positive and negative sides of the application and the feeling of respect in interaction through Tinder. These results give support to the assumption that a men's norm is prioritised in the design of the app and women's needs are disregarded due to gender bias in development. It is however possible that design is not affected by gender differences and that those differences in the user experience occur for a different reason. In order to explore gender bias in design, another study was conducted to detect whether gender affects the decisions made in the design process. A full explanation of that consecutive study is detailed in Chapter 5).

Whilst relationships cannot be reduced to a gender binary perspective, the study of the man-woman dynamic is still very important for the understanding of the hidden beliefs of a gender hierarchy which promotes a gender imbalance. That dynamic might not only be seen within heterosexual and homosexual interactions but also within family structures, labour structures and circles of friends, among others. These patterns of sexism impinge on all of society's layers. Virtual environments could offer a means to re-educate society for interactions in real environments.

The results of these first interviews served as the starting point for this investigation: the research questions emerged following this analysis and not prior to it. Through a review of the literature on gender and design emerged the central research question concerning gender effects in the design of mobile applications, and this first exploration provides evidence that women's needs might be neglected. The subsequent interviews conducted with both men and women during phase 2 provided more support to the investigation of bias and gender, which was in turn crucial to developing a method to investigate bias, as described in the next chapter (see Chapter 5). The following studies concentrate on the presence of gender biases during the design of the experience of a mobile application and on the use of gender-neutral tools to promote gender inclusivity.

Chapter 5

User study: gender biases in the design of the dating experience

5.1 Introduction

Since each designer has their own experiences, beliefs, cultural and educational background, their own way of thinking – regardless of any common ground in the design process – one may safely assume that each designer will understand users' needs in their own particular manner and approach solutions uniquely. These differences will possibly be ingrained in the resulting design of a product or service. However, personal qualities shared among designers would also be visible in resulting designs. In particular, the assumption that the gender of a designer or gender composition of a design team results in traces in the design produced guides this study. In design, differences may be subtle and, accordingly, not affect the user experience or, conversely, substantial enough to affect the user-artefact or user-service interaction.

As reported in the literature review (see Chapter 2), there are some mechanisms assumed to be implicated in gendered artefacts (Bath, 2014), from which two are connected to problematic understandings of users: an I-methodology in which design decisions are based on designers' own beliefs (Akrich, 1995), and the inscriptions of gender stereotypes (Oudshoorn et al., 2004). These issues are purported to be caused by a lack of user research (Williams, 2014; Portugal, 2008; Oudshoorn et al., 2004), the misrepresentation of women during user research (Rommes, 2014), the use of gender stereotypes in user definition (van Oost, 2003; Wikberg-Nilsson et al., 2010; Turner & Turner, 2011; Marsden & Haag, 2016; Portugal, 2008; Kuniavsky et al., 2012), and bias in development (Friedman & Nissenbaum, 1996).

Technological developments are assumed to be gender biased, for women are not well represented in design teams and in user research (Fountain, 2000; Wajcman, 2000; Ashcraft et al., 2016), designers are likely to embed developments with their own opinions (Bath, 2014; Oudshoorn et al., 2004; Akrich, 1995; Massanari, 2010; Mulder & Yaar, 2006; Pruitt & Adlin, 2006; Fleming & Koman, 1998), women have low levels of influence in teams discussions (Rommes, 2014; Karpowitz et al., 2012; Williams, 2014), and due to a speculative

unconscious tendency to consider men as the typical users of technological artefacts (Friedman, 1996; Bradley et al., 2015).

In phase 1 of the preceding study with women alone (see Section 4.3, Chapter 4), it was detected that more than half of the interviewees uninstalled the application due to feeling frustrated. These results suggest that the unsatisfactory women's experience and the disregard of their needs may have been caused by gender bias in design. This hypothesis may be tested empirically. A further rationale for this hypothesis may be found in studies that point to substantial gender differences regarding users' preferences in design and designers' preferences in graphical design.

These studies reveal, for example, that women and men have different needs regarding the design of technological products, such as women benefiting more from wider displays (Czerwinski et al., 2002) and being more likely to engage in computer science courses through gender-neutral online environments (Metaxa-Kakavouli et al., 2018). Moreover, it was identified that women and men, either as users or designers, have different preferences for design elements such as colours, forms and textures (Moss & Colman, 2001; Moss et al., 2006; Xue & Yen, 2007).

These studies, however, do not confirm whether there are gender biases in the design process, since the designers participating in these studies are not making choices for the same user, and sometimes not even for the same product. The analysis of the decision making process in the design of the digital city of Amsterdam revealed that the resulting system embodied a gender script and that designers were inclined to use the "I-methodology" as a technique to represent users, despite the initial drive to deliver an inclusive design solution (Rommes et al., 1999). This indicates that bias was likely to occur when decisions were not grounded in user research, but rather in biased user representations. The fact that the project targeted many users for its inclusive quality, there was more room for designers to empathise more with men users and to embed the system with masculine traits. It therefore remains to explore whether gender differences emerge when designers take decisions for the same user.

In order to explore bias in design, the user's and the product's description should remain the same for every designer participating in a study for that purpose. In other words, given the same user, same needs, same context, and same service, do designers reveal any statistically significant difference in the definition of the design project's requirements? Moreover, as indicated earlier, some authors argue that there is a proclivity to consider the user a man (Friedman, 1996; Bradley et al., 2015), an assumption that is also tested in this study.

In order to investigate whether the gender of designers has a measurable impact in the design of mobile applications, a study was designed to compare the decisions made by women and men. The main idea was that participants use some simple design tools to establish design requirements for a general dating application given the same user and service. Solutions produced by men and women were compared in order to find significant differences. Since the design of mobile apps is an activity engaged in by both design and computer science communities, it seemed appropriate to recruit participants with these two backgrounds – in this case, students taking computer science and design courses. The analysis of the results for the two groups, however, were first handled separately and then compared later.

This study was approved by the Research Ethics Committee within the School of Computer Science and Statistics (SCSS) at Trinity College Dublin before being carried out.

5.2 Research design

Women and men participating in the study individually completed tasks that together aimed to set requirements for the design of a fictitious online dating application. They were presented with the description of the user as a “persona” and the description of the context and service as a “scenario”, and three design tasks.

5.2.1 Participants

The recruitment process resulted in 105 volunteers among students at Trinity College Dublin (TCD) and the National College of Art and Design (NCAD). 56 participants were taking computer science courses at TCD and 49 were taking interaction design (BA or MA) or product design (BA) courses at NCAD. University students studying computer science were deemed appropriate participants in this study because their subject inherently involves design tasks. The TCD sample was composed of 28 women and 28 men, their mean age was 19 years old and the standard deviation for age was 1.16. The NCAD sample was composed of 22 women and 27 men, their mean age was 23 years old and the standard deviation for age was 4.22.

5.2.2 Recruitment

Three strategies were used to recruit participants: online notice boards, printed notices and face-to-face recruitment. Participants who completed the tasks received a voucher as remuneration for their participation. The first group of participants (TCD) received a €10 voucher and the second group (NCAD) a €20 voucher. The remuneration of the second group was increased since no student expressed an interest in participating during the first attempt to recruit design students at NCAD. All the students who participated were recruited in person, as online notice boards and printed adverts did not prove effective in this study.

5.2.3 Description

Participants received a textual explanation about persona and scenario techniques (for details on those techniques, see Sections 2.1 and 2.6 in Chapter 2), since these are common tools used in the design of applications, in order to create a common ground in the design process. They were asked to perform three tasks and to answer two questions. The tasks involved setting requirements for design, which is the stage of the design process when the problem (or opportunity) and the user are intensely analysed. Thus, the tasks consisted of determining the application’s behaviour through a set of tools; prior to the ideation stage (when requirements are transformed into solutions). Participants were informed of a particular persona and scenario.

The tasks were developed based on feedbacks from users in the first study. Some of the features in the third task were suggested by users as potential improvements of their experience of Tinder. Other ideas for the

three tasks derive from the interview reports. The subjective analysis of the results revealed some expectations, achievements, perceptions, concerns and frustrations. That disclosure guided the creation of the feelings, values and communication engagement in task 1, the adjectives to describe the app behaviour in task 2, and some of the features in task 3.

5.2.4 Gender neutrality

As explained in the literature review (Chapter 2), the use of the term "gender-neutral" in this research is justified for the connection of textual user descriptions with studies on gendered pronouns and neutral language, despite the fact that gender neutrality has been considered problematic in the design field. As highlighted before, the term can imply a design that attempts to include all users by ignoring gender, and accordingly, gender issues that should be addressed in order to promote gender-inclusivity in design (Churchill, 2010; Wajcman, 1991; Rommes et al., 2012).

Participants were not told that gender differences were being analysed (see Appendices I, K, and L with the materials provided), as doing so could encourage an inclination to consider gender as a design factor and confound the analysis of gender biases. However, a debriefing email with the study results were offered to participants who indicated their interest. A neutral persona was developed with the help of a HCI research team at Trinity College Dublin and a gender expert to avoid marking the texts with gender stereotypes. In order to create a neutral persona, two personas (man and woman) were mixed into a single one. The first versions of a neutral persona and neutral scenario revealed stereotyped ideas and gendered style of writing. They were redesigned until the team was not able to say whether the text described a man or a woman.

The scenario was adapted to a first person narrative in order to ease the gender-neutral description. It was decided to not attach a fictitious gender-neutral name to the persona having noted that individuals respond to names used, in general, by both men and women on the basis of namesake individuals of whom they have awareness, and this may distort judgements of gender neutrality. With this approach, it was possible to estimate whether participants assign gender to the target user. The target user was explained through the persona, and the scope of the application was explained through the scenario. The persona shown in Figure 5.1 and the scenario below were provided to the participants.

5.2.5 Scenario and persona

Scenario: "I met some friends for a drink the other evening. One of them told me about their experience with this new dating app. I'd never used one before and so had some questions about how it works. My friend opened it there and then to show everybody the main features. I was curious to try it out but not so confident about installing it. My friend let me use it for a few minutes just to get a feel for it. I enjoyed the experience, so when I got back home, I decided to install the app on my own phone, to give it a go. I used the application for half an hour or so and matched with some interesting people. I've been using the app every night since, both to look for new people to match with, and to keep the conversation going with some of those I connected with previously.

Everything really seemed to click with this one person, and we have a date coming up next Friday. I'm really looking forward to it."

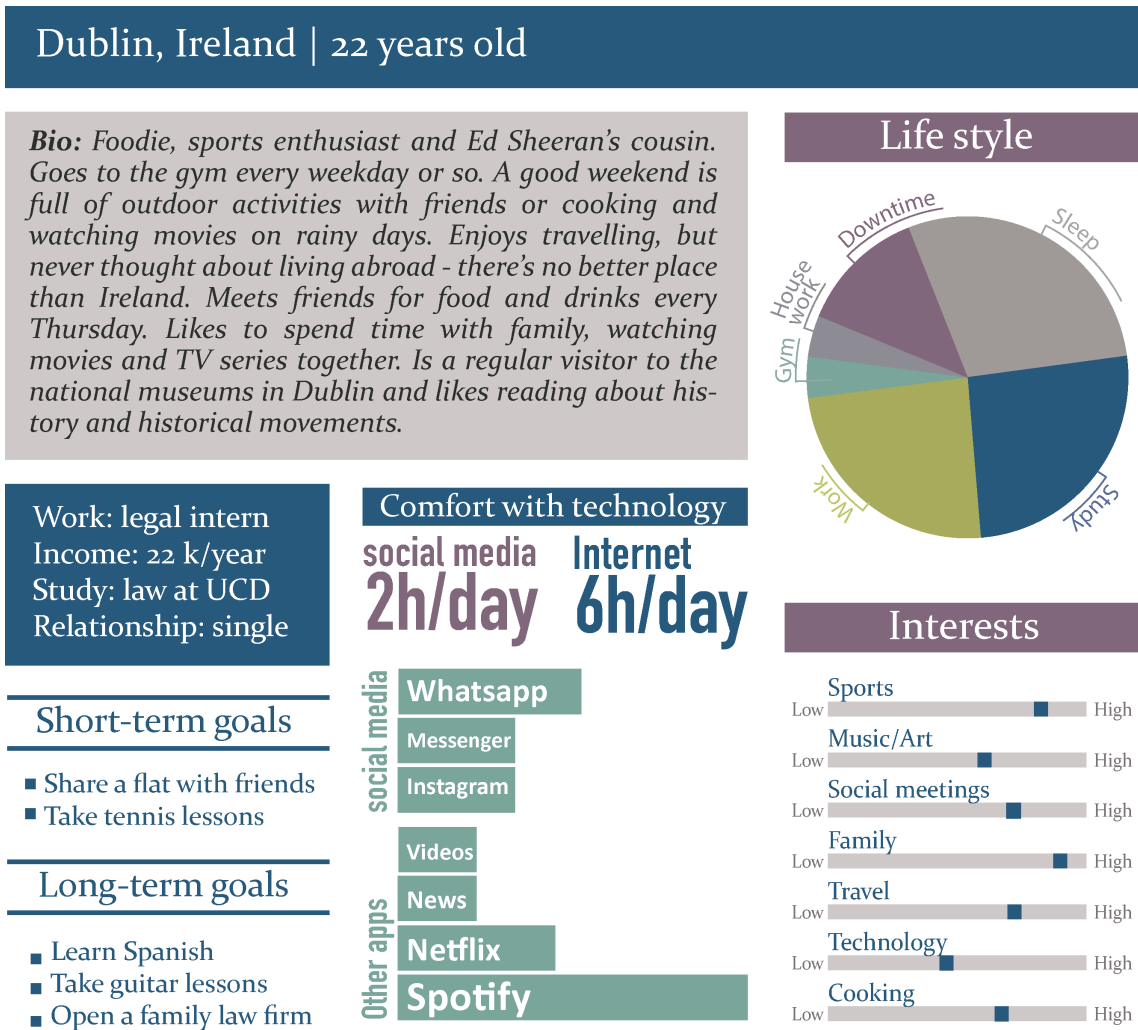


Figure 5.1: The neutral persona: a user description with no gender label.

5.2.6 Procedures

Each participant received the same explanations about the techniques and the same instructions as to how to perform the tasks (see Appendices K, and L). Each participant engaged with three design tasks. Response times were not recorded, but participants took about 15-20 minutes to complete the tasks.

The idea of the first task derives from the card sorting technique (see Figure 5.2) used to define the navigation hierarchy of a website (Hudson, 2005) or an application, in which the content and information architecture are established by users. The first idea was to give participants a set of cards, which would be organised into three groups and identified by three different colours: the feeling cards (what should users feel?), value cards (which values should be supported?), and the engagement cards (how should the communication feel?). The cards were defined considering previous studies on gender differences in the experience of online dating apps (ODS) and the literature review on hookup culture (see Chapters 4 and 2). Participants would be asked to organise cards containing topics/categories into groups as in the example depicted in Figure 5.2. The cards on top reflect what

are considered the most important elements in the design project while those on the bottom indicate unnecessary elements.

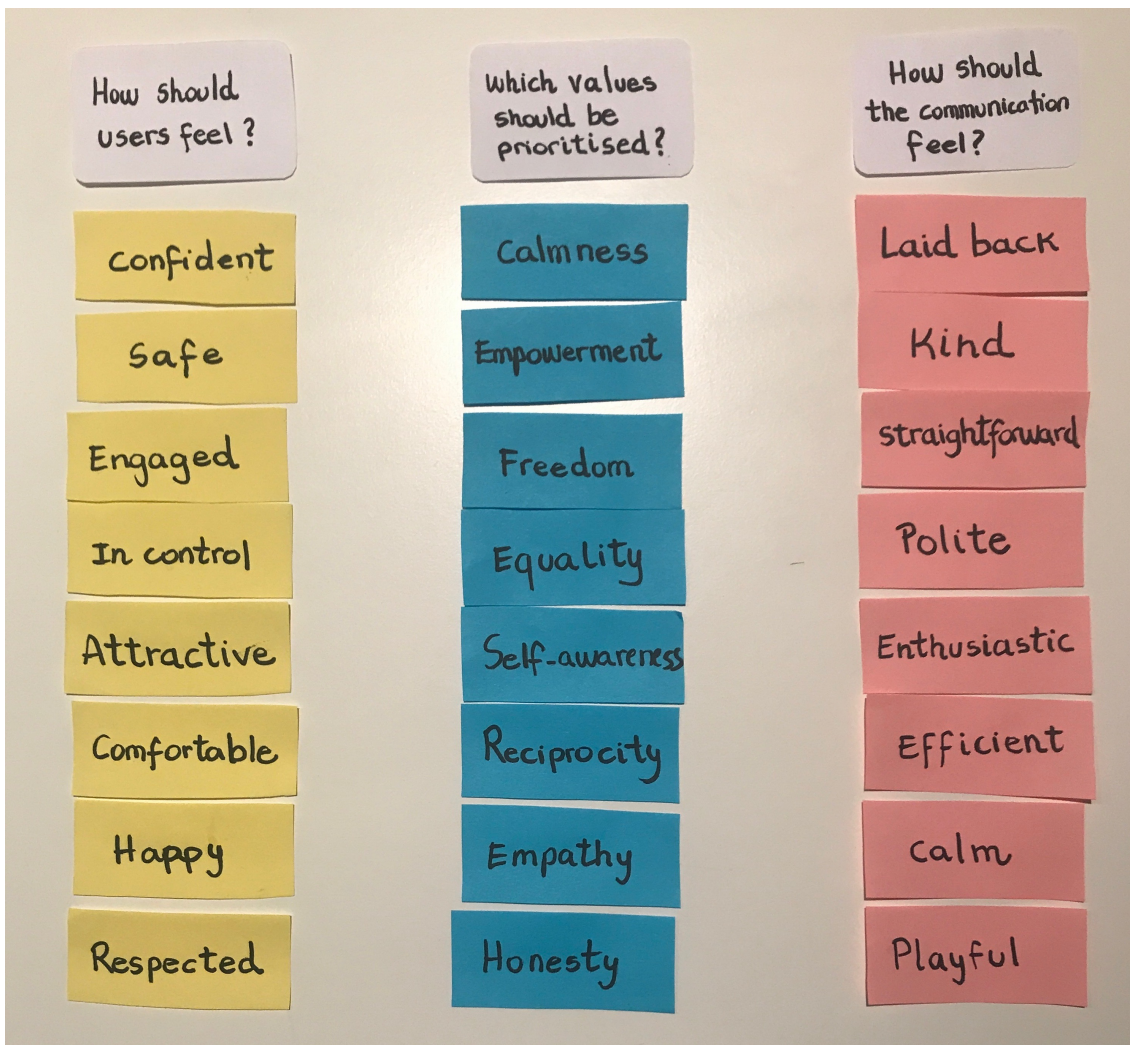


Figure 5.2: Card sorting for: emotions, values and engagement.

However, to make the task more practical and straightforward it was decided that participants would simply assign a priority order for each group of words (previously a group of cards). Participants were asked to assign values varying from 1 to 8 (the number of words in each group) in order of importance – 1 to the most important card and 8 to the least important card – considering the persona described. They were told that they could not repeat numbers and should check for this after completion. Ambiguous or incomplete responses were disregarded.

1 - Most important / 8 - Least important

How should the persona feel?	Which values should be prioritised?	How should the communication feel?
<input type="checkbox"/> Comfortable	<input type="checkbox"/> Empowerment	<input type="checkbox"/> Calm
<input type="checkbox"/> In control	<input type="checkbox"/> Freedom	<input type="checkbox"/> Kind
<input type="checkbox"/> Engaged	<input type="checkbox"/> Privacy	<input type="checkbox"/> Straightforward
<input type="checkbox"/> Safe	<input type="checkbox"/> Honesty	<input type="checkbox"/> Polite
<input type="checkbox"/> Confident	<input type="checkbox"/> Empathy	<input type="checkbox"/> Effective
<input type="checkbox"/> Happy	<input type="checkbox"/> Reciprocity	<input type="checkbox"/> Enthusiastic
<input type="checkbox"/> Respected	<input type="checkbox"/> Self-awareness	<input type="checkbox"/> Playful
<input type="checkbox"/> Appreciated	<input type="checkbox"/> Equality	<input type="checkbox"/> Adventurous

Figure 5.3: Task 1: defining feelings, values and the communication approach.

During the second task, participants were asked to rate personality traits that would define the experience of a dating application (see Figure 5.4). This personality serves to shape the application's behaviour, and consequently the way people engage with the application in a virtual environment. The design of the application's behaviour highlights the important role of the application in the dialogue with the user, with both the user and the application having active roles. When designers assign a specific behaviour to the application, they assign a personality to it. This statement refers to the concept of the *techsona* coined by Bødker and Klokmoose (2013) to explain the importance of defining an identity for the product or service as well as for the persona, so the interaction can be well planned, and actions and reactions designed. The idea of designing a product's personality through feelings and values was explored by Jordan (2002) and it is useful for users to understand how to interact with the product (Mugge, Govers, & Schoormans, 2009). For example, if it is stipulated that the application should be straightforward to use, then it is expected that it will react and answer users' requests in a straightforward manner. In order to define the app's personality in this study, participants had to rate the importance of several personal adjectives and adjectival phrases through a Likert scale ranging from one (definitely not important) to five (definitely important).¹ The items rated are detailed in Figure 5.4.

Finally, participants were asked to rate putative system features designed for this study through a Likert scale ranging from one (definitely not important) to five (definitely important): Figure 5.5 shows the features available for rating. These feature ideas derive from the results reported in the previous study (see Chapter 4), which made it possible to identify dating application features that women and men highlighted indicated either as problematic or as desirable.

¹The importance ordering here is the reverse of that in the first task.

	Definitely NOT	Probably NOT	Neutral	Probably YES	Definitely YES
Discreet					
Caring					
Easygoing					
Cheerful					
Open-minded					
Honest					
Creative					
Intriguing					
Down to earth					
Polite					
Flexible					
Straightforward					
Committed					
Reliable					
Engaging					
Proactive					
Spontaneous					

Figure 5.4: Task 2: Personality setting table.

Feature	Function
Join a group	Users can find all those with one common interest in the same place.
Relationship mode	Users can filter by motivation and quickly find those looking for a relationship.
Time is ticking	Users have to engage more with their matches or lose them due to inactivity.
Gift voucher	Users can help a friend who needs an extra push by giving them a voucher for paid features.
Stay safe	Users can find protocols and features that help them to stay safe during encounters.
Self-awareness	Users can get statistical reports to better understand what they're doing wrong and well.
Chemistry	Users can enable video and voice features to get to know their matches better before meeting.
Match boost	Users can define their preferences and let the system give likes on their behalf.
Smart move	Users can get tips to improve conversation and keep matches interested in them.
Flirting tips	Users can get tips to improve their confidence and approach.
Rate users	Good behaviour gets more visibility; bad behaviour gets penalties.
Common interests	The more they have in common, the more visible their profiles will be to each other.

Figure 5.5: Task 3: Feature rating list.

After they finished the design tasks, participants were asked to indicate the persona's perceived gender and the level of difficulty in designing without taking into account their own preferences. With respect to the analysis of perceived gender, this was posed as an open-ended question: "Which gender came to your mind when you read about the persona and during the completion of the tasks?" (see Appendix L.2). With respect to the difficulty of designing for preferences other than the designer's own, three response options were provided: "easy", "medium" and "difficult". Since the persona was contrived in a gender-neutral fashion, indications of gender would reveal the participant's perception/projection of the persona's gender. The responses were analysed to determine whether there was a tendency to consider the user as a man or not and a tendency to imbue the application with designers' own experiences and beliefs. Responses to the level of difficulty provided evidence for the hypothesis that design projects are likely to be influenced by personal opinion. For the second group of participants (the design group), a question about noticing the absence of gender in the persona description was added. Participants could indicate either "yes, I noticed" or "no, I didn't notice".

In addition, it was explained to participants that they should answer the questions one by one in the order provided, and that they should not read the questions in advance since this would affect the results. This explanation was an attempt to mitigate the disclosure of the absence of gender in the persona and scenario descriptions before the tasks were performed.

5.2.7 Method of analysis

As the goal of this study was to identify measurable gender differences in the design of mobile applications, the analysis of the datasets of the two groups (design and computer science) is composed of four different tests, which were defined before conducting the study and recruiting participants. The results for the two groups were examined separately (see Section 5.3) and then in a pooled manner (see Subsection 5.3.6). The data sets were tested for independence in four different ways: differences by participants' gender, differences by the persona's perceived gender, differences by participants' gender when designing for a persona perceived as a woman and differences by participants' gender when designing for a persona perceived as a man. The pooled data revealed differences according to participant's background for the four tests in a joint analysis of the two groups. In each of these different cross-classifications of responses, median responses to items were examined within the compared categories.

In describing this study, Section 5.3 (FINDINGS) is not organised by task. The three tasks were analysed jointly and organised by participants' gender, participants' background and personas' perceived gender. A focus is retained on those effects that proved statistically significant using a Wilcoxon test on item response, conditioned on the distinction at stake in each case. Bonferroni corrections were not applied, since the number of tests involved were determined before the study was conducted.

As a non-parametric alternative to a t-test, this test does not compare medians or means directly, but rather the differences in paired groups' mean ranks. However, these differences are many times associated with a difference in the medians of two groups, and the reason why the medians are displayed in the tables. Via analysis

of the medians it was possible to visualise which group assigned more or less priority to each element. In order to analyse the elements that revealed significant differences but the same median for the two groups, a closer look at the distribution helped to visualise the differences. This study focuses on gender-relative differences in prioritisation as reflected in participants' responses – see Table 5.1 for a summary of the possible response categories across the design tasks.

<i>Task</i>	<i>Greatest priority</i>	<i>Least priority</i>
T1: feeling qualities	1	8
T1: value qualities	1	8
T1: communication qualities	1	8
T2: techsona personality qualities	5	1
T3: feature qualities	5	1

Table 5.1: Summary of ranking scales and values indicating maximum and minimum priorities for each task.

5.2.8 Ethical considerations

There are some ethical considerations that should be taken into account when evaluating the research design, although it created no personal risks for participants. In particular, the omission of mention of the gender aspect of the research project in the information provided to participants means that they were informed with the truth, but not the “whole truth” in advance of participating. However, refraining from mentioning gender in advance was crucial to the conduct of this study. As a compensatory measure, participants were given the possibility of receiving a debriefing via email afterwards. None took up this possibility.

5.3 Results

Considering the nature of the data analysed and the study goal, a nonparametric Mann-Whitney Test (Wilcoxon) was used to detect significant differences between the design requirements highlighted by men and women, as measured in the ranks and scores assigned to the elements ranked in the tasks. Each element was analysed separately. The null hypothesis was that there was no difference between the values assigned by men and women. In discussing the results, emphasis was given mainly to the effects that are statistically significant ($p < 0.05$).

The tables with the results of the study display the number of the task in the first column, the elements with statistical significance in the second column, the median values for participants' gender or the persona's perceived gender compared in the third and fourth columns, and the result of that difference that leads to the prioritisation of that element in the fifth column (see Table 5.7, for example).

Interpretation of the results reported in this Section (RESULTS) is found in Section 5.4 (DISCUSSION) Results concerning the perception of the persona's gender and difficulty in avoiding personal bias are discussed in the Subsection 5.4.1. Differences by participants' and persona's perceived gender are discussed in Subsection

5.4.2. The discussion of significant differences between design and computer science participants is found in Subsection 5.4.3.

5.3.1 Perception of the persona’s gender and personal bias

Computer science students

This first analysis refers to the feasibility of designing with gender-neutral personas. In the computer science group composed of 56 students, 28 participants were women and 28 were men. Among women, 13 believed the persona was a woman while 15 believed the persona was a man. Among men, 16 believed the persona was a woman and 12 believed the persona was a man (see Table 5.2). Thus, a χ^2 test of the independence of participant gender and judgements of persona does not reveal a significant difference within the computer science group: $\chi^2 = 0.28608, df = 1, p = 0.5927$. One may not reject the null hypothesis that there is no interaction between participant gender and perceived persona gender.

Moreover, participants were asked to evaluate if it was easy or difficult to make design decisions for a persona without taking their own personal beliefs into account. Among women participants, 6 found it easy, 5 found it neither easy nor difficult, and 17 found it difficult. Among men participants, 10 found it easy, 1 found it neither easy nor difficult, and 17 found it difficult (see Table 5.3). The interaction between participant gender and perceived difficulty is not significant in the computer science group: $\chi^2 = 3.6667, df = 1, p = 0.1599$. Therefore, it is not safe to reject the null hypothesis that there is no interaction between participant gender and reported difficulty in designing for a self-dissociated persona.

<i>Participant’s gender</i>	<i>Persona:Woman</i>	<i>Persona:Man</i>	<i>Total</i>
Woman	13	15	28
Men	16	12	28
Total	29	27	56

Table 5.2: Perception of the neutral persona’s gender (counts of responses, by category) by computer science students: participant gender vs. perceived gender.

<i>Participant’s gender</i>	<i>Easy</i>	<i>Medium</i>	<i>Difficult</i>	<i>Total</i>
Women	6	5	17	28
Men	10	1	17	28
Total	16	6	34	56

Table 5.3: Perception of the level of difficulty in designing without personal biases (counts of responses, by category) among computer science students.

Design students

In the design group composed of 49 students, 35 believed the persona was a man and 11 believed the persona was a woman. Of the women, 5 believed the persona was a woman and 17 that the persona was a man. Among men, 6 believed the persona was a woman and 18 believed the persona was a man (see Table 5.4). Thus, a χ^2 test of the independence of participant gender and judgements of persona does not reveal a significant difference within the design group: $\chi^2 = 2.6367, df = 3, p = 0.4511$. One may not reject the null hypothesis that there is no interaction between participant gender and perceived persona gender. However, a binomial test revealed that participants, in general, were significantly more likely to perceive the persona as a man within the design group. Considering that participants were expected to guess the persona's gender in a balanced way (50% women / 50% men), the binomial test reveals a significant proclivity to identify the persona as a man within this group: number of successes = 35, number of trials = 46, $p - value = 0.0005356$.

With regard to the perceived difficulty of making design decisions for a persona without taking personal beliefs into account, 4 women found it easy, 14 found it neither easy nor difficult (medium), and 6 found it difficult. Among men, 2 found it easy, 14 found it neither easy nor difficult, and 11 found it difficult (see Table 5.5). The interaction between participant gender and perceived difficulty is not significant in the design group: $\chi^2 = 0.97049, df = 2, p = 0.6155$. Therefore, it is not safe to reject the null hypothesis that there is no interaction between participant gender and reported difficulty in designing for a self-dissociated persona.

During the session with design participants, another question was added to the study. It seemed useful to know whether students perceived the absence of gender in the persona and scenario descriptions. This only came to light after conducting the study with computer science students, which is why it was not posed in the case of the first batch of participants. These results indicate that among women 15 did not notice the absence while 7 did so. Among men, 23 did not, and 4 did, notice the lack of gender in the description of the persona and scenario. In total, 38 participants did not notice the absence of gender and 11 did so (see Table 5.6). The interaction between participant gender and the perception of the lack of gender is not significant in the design group: $\chi^2 = 1.1549, df = 1, p = 0.2825$. Moreover, the interaction between perceived difficulty and noticing the absence of gender in the persona and scenario descriptions is also not significant: $\chi^2 = 1.9859, df = 2, p = 0.3705$.

<i>Participant's gender</i>	<i>Persona:Woman</i>	<i>Persona:Man</i>	<i>Persona:No Gender</i>	<i>Total</i>
Women	5	17	0	22
Men	6	18	1	25
Total	11	35	1	47

Table 5.4: Perception of the neutral persona's gender (counts of responses, by category) by design students: participant gender vs. perceived gender. From the original sample (N=49), 47 participants responded to this question and 2 were absent.

<i>Participant's gender</i>	<i>Easy</i>	<i>Medium</i>	<i>Difficult</i>	<i>Total</i>
Women	2	14	6	22
Men	2	14	11	27
Total	4	28	17	49

Table 5.5: Perception of the level of difficulty in designing without personal biases (counts of responses, by category) by design students.

<i>Participant's gender</i>	<i>"Did not notice"</i>	<i>"Noticed"</i>	<i>Total</i>
Women	15	7	22
Men	23	4	27
Total	38	11	49

Table 5.6: Perception of the lack of gender definition in the persona's description by design students.

5.3.2 Test 1: Differences by participants' gender

Computer science students

When comparing the values assigned by men and women, men tended to prioritise a "calm" form of communication and the "relationship mode" feature more than women, and women to embed the application with a value of "honesty" value and "honest" behaviour more than men (see Table 5.7).

In the role of designers, women in the group rated feeling safe, the value of honesty, and an enthusiastic form of communication as the most important elements in task 1, an engaging personality in task 2, and the common interests feature in task 3. The lowest values were assigned to feeling appreciated, the value of reciprocity, and a calm communication in task 1, a committed personality in task 2 and the gift voucher feature in task 3. For the full summaries of ratings of that group, see Figure M.2 in Appendix M.

Men, in turn, rated feeling comfortable, the value of privacy, and a calm communication higher for task 1, an engaging personality in task 2, and the common interests feature in task 3. The lowest values were assigned to feeling appreciated, the value of reciprocity, and a polite form of communication in task 1, a committed personality in task 2, and the gift voucher feature in task 3. The full results for decisions made by men are displayed in Figure M.4 in Appendix M.

<i>Task</i>	<i>Element</i>	<i>Women</i>	<i>Men</i>	<i>Prioritised by</i>
T1: value	Honesty*	2	3	Women
T1: communication	Calm***	6	3	Men
T2: personality	Honest*	5	4	Women
T3: feature	Relationship*	3	4	Men

Table 5.7: Median responses to items, according to the gender of computer science participants. Statistical significance as assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

Design students

Analysing gender differences in decision making, men in the design group were more likely to embed the app with a value of “honesty”, and to prioritise the “time is ticking” and “self-awareness” features compared to women, while women were more likely to embed the app with an “easygoing” personality when compared to men.

Women designers gave higher priority to comfort, privacy and politeness in task 1, to the easy going personality in task 2, and to the common interests feature in task 3. The lowest priorities were given to feeling appreciated, reciprocity, and effectiveness in task 1, to the committed personality in task 2, and to the gift voucher feature in task 3. For a complete summary of responses, see Figure N.2 in the Appendix N.

Men, in turn, rated the feeling of comfort, honesty, and playful communication higher in task 1, an honest personality in task 2, and the common interests feature in task 3. This group rated feeling appreciated, the value of empowerment, and a straightforward form of communication lower in task 1, a committed personality in task 2, and the gift voucher feature in task 3. The summaries of these responses are displayed in Figure N.4 in the Appendix N.

<i>Task</i>	<i>Element</i>	<i>Women</i>	<i>Men</i>	<i>Prioritised by</i>
T1: value	Honesty*	3	2	Men
T2: personality	Easygoing*	5	4	Women
T3: feature	Time is Ticking*	2	3	Men
T3: feature	Self-awareness*	2	3	Men

Table 5.8: Median responses to items, according to the gender of design participants. Statistical significance as assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

5.3.3 Test 2: Differences by personas’ gender

Computer science students

In order to find whether participants (both men and women) tended to assign priorities differently when designing for a woman or a man, the same test was carried out, by comparing the persona’s gender rather than the

participant’s gender. The results show that participants tended to think that feeling “happy”, and that enhancing “empathy” and “reciprocity” would be more important to men users, while enhancing “privacy” and “equality”, and embedding the application with a “discreet” and “caring” personality would be more important to women users (see Table 5.9).

Participants who perceived the persona as a woman, rated feeling comfortable, the value of privacy, and a kind communication higher in task 1, an engaging personality in task 2 and the stay safe feature in task 3. The lowest values in the rank were assigned to feeling appreciated, to the value of reciprocity, and an adventurous communication in task 1, to a committed personality in task 2, and to the gift voucher feature in task 3. The summaries of values for the persona perceived as a woman by the computer science group are displayed in Figure M.1 in the Appendix M.

Participants who perceived the persona as a man, rated feeling safe, the value of honesty, and a playful communication as the most relevant elements in task 1, an engaging personality in task 2, and the common interests feature in task 3. Feeling appreciated, self-awareness, and politeness received the lowest ratings in task 1, the discreet and committed personality in task 2, and the gift voucher feature in task 3. For the full summaries of values, see Figure M.3 in Appendix M.

<i>Task</i>	<i>Element</i>	<i>Persona: Woman</i>	<i>Persona: Man</i>	<i>Prioritised for</i>
T1: feeling	Happy*	6	4	Persona: man
T1: value	Privacy*	2	3	Persona: woman
T1: value	Empathy*	6	4	Persona: man
T1: value	Reciprocity***	7	5	Persona: man
T1: value	Equality**	3	5	Persona: woman
T2: personality	Discreet*	4	3	Persona: woman
T2: personality	Caring**	4	3	Persona: woman

Table 5.9: Median responses to items, according to personas’ perceived gender. Statistical significance in the difference as a function of perceived persona gender, assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

Design students

By analysing decisions made when designing for the persona perceived as woman or man, design students, in general (both men and women, together), were more likely to consider that women would like to feel “safe” and to use an app that emulates an “honest” personality.

When the persona was perceived as a woman, the elements judged as more important by participants in task 1 were feeling safe, the value of honesty, and a playful form of communication. The elements rated lower in task 1 were feeling appreciated, the value of reciprocity and a playful form of communication. In task 2, an

honest personality was the most highly rated element and a committed one was the lowest. For task 3, common interests was the feature rated higher and match boost rated lower. The summaries of the ranked values provided by design students for the persona perceived as woman are displayed in Appendix N.1.

Participants who perceived the persona as a man, rated feeling comfortable, the value of privacy, and a playful form of communication higher in task 1, an easygoing personality in task 2, and the common interests feature in task 3. The lowest values were given to the feeling of appreciation, the value of reciprocity, and an effective form of communication in task 1, a committed personality in task 2, and the gift voucher feature in task 3. For a complete summary of responses, see Figure N.3 in the Appendix N.

<i>Task</i>	<i>Element</i>	<i>Persona: woman</i>	<i>Persona: man</i>	<i>Prioritised for</i>
T1: feeling	Safe *	1	4	Persona: woman
T2: personality	Honest *	5	4	Persona: woman

Table 5.10: Median response to items, according to personas' perceived gender. Statistical significance in the difference as a function of perceived persona gender, assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

5.3.4 Test 3: Differences by participant's gender for the persona perceived as a woman

Computer science students

In the computer science group, men were more likely than women to prioritise a “calm” form of communication and to embed the application with the “relationship” filter (see Table 5.11) when designing with a persona perceived as a woman in mind.

Persona: Woman				
<i>Task</i>	<i>Element</i>	<i>Women</i>	<i>Men</i>	<i>Prioritised by</i>
T1: communication	Calm*	5	3	Men
T3: feature	Relationship*	3	4	Men

Table 5.11: Median responses to items, according to the gender of participants in computer science courses, given a persona perceived as a woman. Statistical significance as assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

Design students

Among design students, men were more likely to prioritise a “playful” form of communication while women were more likely to embed the app with an “easygoing” personality when designing with a persona perceived as a woman in mind (see Table 5.12).

Persona: woman				
<i>Task</i>	<i>Element</i>	<i>Women</i>	<i>Men</i>	<i>Prioritised by</i>
T1: communication	Playful*	5	1	Men
T2: personality	Easygoing*	5	4	Women

Table 5.12: Median responses to items, according to the gender of participants in design courses, given a persona perceived as a woman. Statistical significance as assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

5.3.5 Test 4: Differences by participant’s gender for the persona perceived as a man

Computer science students

Within the computer science group, men were more likely to prioritise a “calm” form of communication through the application and women to embed the application with a “cheerful” and “down to earth” personality (see Table 5.13) when the persona was perceived as a man. Recall again from Section 5.2.7 (Method of analysis) that the Tables report the median responses to items, by category, and that the Wilcoxon test compares paired groups’ mean ranks: this explains why the test of differences in response to “cheerful” by participant gender yields significance, while the median response is exactly the same for both genders.

Persona: man				
<i>Task</i>	<i>Element</i>	<i>Women</i>	<i>Men</i>	<i>Prioritised by</i>
T1: communication	Calm***	7	4	Men
T2: personality	Cheerful*	4	4	Women
T2: personality	Down to earth*	4	3	Women

Table 5.13: Median responses to items, according to the gender of participants in computer science courses, when the persona was perceived as a man. Statistical significance as assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

Design students

Within the design group, men were more likely to embed the application with a value of “honesty” value and women with a value of “empowerment” value when the persona was perceived as a man (see Table 5.14).

Persona: man				
<i>Task</i>	<i>Element</i>	<i>Women</i>	<i>Men</i>	<i>Prioritised by</i>
T1: value	Empowerment (value)*	6	7	Women
T1: value	Honesty (value)*	4	3	Men

Table 5.14: Median responses to items, according to the gender of participants in design courses, when the persona was perceived as a man. Statistical significance as assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

5.3.6 Differences between computer science and design participants

Differences by gender

Comparing gender within the two groups together, men were more likely than women to embed the app with a “calm” form of communication and to prioritise the “self-awareness” and “rate users” features than women (see Table 5.15).

<i>Task</i>	<i>Element</i>	<i>Women</i>	<i>Men</i>	<i>Prioritised by</i>
T1: communication	Calm**	6	4	Men
T3: feature	Self-awareness*	3	3	Men
T3: feature	Rate users*	3	4	Men

Table 5.15: Median responses of both design and computer science participants to items, according to participants’ gender. Statistical significance as assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

Differences by the persona’s perceived gender

By comparing the decisions made for the persona when perceived as a woman and as a man by the two groups together, it was possible to detect that participants were more likely to prioritise a feeling of “safety” and the value of “equality” when the persona was perceived as a woman, and a feeling of “happiness” feeling and values of “empathy” and “reciprocity” when the persona was perceived as a man (see Table 5.16).

<i>Task</i>	<i>Element</i>	<i>Persona: woman</i>	<i>Persona: man</i>	<i>Prioritised for</i>
T1: feeling	Safe*	1.5	3.5	Persona: woman
T1: feeling	Happy*	6	4	Persona: man
T1: value	Empathy**	6	4.5	Persona: man
T1: value	Reciprocity**	7	6	Persona: man
T1: value	Equality*	3	5	Persona: woman

Table 5.16: Median responses of both design and computer science participants to items, according to the persona’s perceived gender. Statistical significance as assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

Differences by participants’ gender and persona’s perceived gender

A closer analysis of gender differences in assigning priorities according to the persona’s perceived gender in the data set revealed that men were more likely than women to prioritise a “calm” form of communication and the “relationship” feature (see Table 5.17) when the persona was perceived as a woman. No statistically significant differences emerged for a persona perceived as a man.

<i>Task</i>	<i>Element</i>	<i>Women</i>	<i>Men</i>	<i>Prioritised by</i>
T1: communication	Calm*	5	3	Men
T3: feature	Relationship mode	3	4	Men

Table 5.17: Median responses to items, given the persona perceived as a woman. Statistical significance as assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

Differences by participants’ background

It seemed appropriate to analyse the differences between the two groups, disregarding gender, in order to understand how these two groups, which have distinct backgrounds, address priorities in the development process when designing for the same persona and the same scenario. Computer science students were more likely to embed the app with an “effective” form of communication, a “creative” and “intriguing” personality, and to prioritise the “self-awareness” feature. Design students, in turn, were more likely to prioritise “empathy” as a value, a “polite” form of communication, and to embed the application with an “honest” and “respectful” personality. These are statistically significant differences ($p < 0.05$).

<i>Task</i>	<i>Element</i>	<i>Computer Science</i>	<i>Design</i>	<i>Prioritised by</i>
T1: value	Empathy*	6	4.5	Design students
T1: communication	Polite*	5	3	Design students
T1: communication	Effective*	6	4	Computer science students
T2: personality	Honest*	4	5	Design students
T2: personality	Creative*	3	4	Computer science students
T2: personality	Intriguing*	4	4	Computer science students
T2: personality	Respectful*	4	4	Design students
T3: feature	Self-awareness*	4	3	Computer science students

Table 5.18: Median response to items, according to the participants' background (computer science X design). Statistical significance as assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

5.4 Discussion

5.4.1 Gender neutrality and personal bias

As previously explained, the gender of the persona was left unspecified in these design sessions. Participants were provided a gender-neutral persona which was created with the help of a design team, in light of the feedback of a gender expert, and validated in a pilot session with PhD students before the study was conducted with undergraduate students. Some students expressed being surprised with the disclosure of the absence of gender in the last question since they did not realise that they had assigned a gender without specific information in that respect. This is the reason why a question was added to the questions asked of the second group in order to understand how many participants would notice the lack of such information. Within the design group, 22% of the participants reported noticing the absence and 78% not doing so. Those who noticed the absence of gender still perceived the persona as either a man or a woman, with the exception of one participant who did not assign any gender and disclosed that no gender came to his mind during the tasks. This is the reason why the classification of these results is binary in nature. Participants read the user description and assigned a gender to the persona according to their understanding of women's and men's personalities and their own biases. In the computer science group, women and men participating in the study assigned genders (man and woman) to the persona in a balanced way. However, in the design group, 71% thought the persona was a man and 22% thought it was a woman. Friedman (1996) has indicated that people would tend to imagine the user of technological developments as a man, however, in this study there was no tendency to consider the user as a man or as a woman within the computer science group, at least when a gender-neutral description of a user was given to participants. But there was a tendency to think of the user as a man within the design group.

The fact that 78% of the design group did not notice the absence of gender in the persona indicates the feasibility of designing with a gender-neutral persona; a persona who is not named and not pictured. This is evidence against the hypothesis that gender is important for establishing the “believability” of personas (Burnett et al., 2016; Grudin, 2006) and that it should be an integral part of their descriptions (Pruitt & Adlin, 2006; Nielsen et al., 2015), as earlier discussed within the literature review of this thesis (see Chapter 2, Section 2.6.)

Nevertheless, there is a strong indicator of participants’ biases towards their own preferences in decision making, since 60% of computer science participants and 35% of design participants found it difficult to make decisions for a user without taking their own preferences and experiences into account, even when the user is defined. From the total sample, 29% of computer science and 8% of design participants found it easy to avoid personal bias. Hence, the assumption that there is gender bias in the design process even when a user-centred design approach is adopted (Williams, 2014) as well as the tendency to design for oneself (Rommes et al., 1999; Oudshoorn et al., 2004; Akrich, 1995; Fleming & Koman, 1998; Pruitt & Adlin, 2006) is supported in this study, by means of the self-assessments of participants. These differences are independent of participants’ gender in both computer science and design groups: i.e. there is no gender effect regarding the experience of finding it difficult to avoid personal biases. Moreover, there is no interaction between this perceived difficulty and noticing the absence of gender in the persona and scenario definition.

The main idea of this study was to bring to light differences in assigning priorities in design according to participants’ gender in order to move forward the discussion of gender bias in design. It was not a priority to discuss the differences in between the groups. However, a brief subjective discussion of statistically significant differences is provided below. This is a subjective attempt to contextualise the results of differences based on previous findings and literature review. However, in-depth interpretation of these differences would require follow-up studies involving groups of participants and users, and the use of techniques such as focus groups to encourage a rich discussion of the findings that goes beyond the scope of this PhD research.

5.4.2 Differences by participants’ gender and persona’s perceived gender

Considering participants’ gender within the computer science group, there was a tendency among women to imbue the application with the value of “honesty” and an “honest” personality, which suggests a women’s claim for transparency in interaction through dating apps within that group. However, within the design group, the value of “honesty” was more likely to be assigned by men than by women. Yet, a closer look at the differences assigned to each persona reveals that participants were more likely to embed the application with an “honest” personality when the persona was perceived as a woman. Men participants in the design group were also more likely than women in that group to prioritise “time is ticking” and “self-awareness” features, although median ratings for both men and women do not highlight that feature as “important”. “Time is ticking” refers to a feature that encourages users to start a conversation with those people already matched and “self-awareness” refers to a feature that would provide feedback on the user’s dating statistics. Women in the design group were more likely to embed the application with an “easygoing” personality, which was considered important by both women and

men in the group. Taking a closer look at the decisions made with respect to the persona's perceived gender, "easygoing" appears more likely to be embedded as a trait in the app by women when the persona was perceived as a woman.

Within the computer science group, men tended to prioritise a "calm" form of communication and to provide the application with a "relationship mode" feature in which users can easily find those who are looking for a relationship. It is natural to speculate as to why men prioritised this "relationship mode" feature. A closer look at each persona reveals that men were more likely than women to prioritise a "calm" form of communication when designing for both men and women and to prioritise a "relationship mode" when designing for a woman. That the "relationship mode" feature was preferred by men designing for a woman (Table 5.11) than those designing for a man (Table 5.13) reflects a masculine perception of women's needs. The previous study on gender differences in the experience of Tinder (see Section 4.4, Chapter 4), however, revealed that men and women are as likely to look for a relationship on dating applications, although both tended to think that women are usually looking for a relationship while men are looking for sex. This reveals that a gender stereotype depicting men's lack of interest in relationships does not entirely correspond to reality, since, according to that study, men were as open as women to engaging in new relationships. Moreover, the difference in median ratings assigned by men and women in that group regarding a "calm" form of communication appears both when a persona is perceived as a woman and as a man. It is possible to assume that this aspect of communication was not important for women in that group, who assigned lower ratings for that element when designing either for a persona perceived as a woman (median = 5) or for a persona perceived as a man (median = 7), while men considered it more important than women when the persona was either perceived as a woman (median = 3) or as a man (median = 4).

Participants (both men and women) in the computer science group were more likely to prioritise the feeling of "happiness" and to provide the application with values of "empathy" and "reciprocity" when the persona was perceived as a man than as a woman. This might reveal that both genders think a man user would need more responsive interactions to remain engaged than a woman user and that feeling happy would be more relevant for the adoption of the application among men when compared to women. When designing for the persona perceived as a woman, participants (both men and women) tended to embed the application with values of "privacy" and "equality", and a "discreet" and "caring" personality. This result might also indicate a gender stereotype, since the results of previous studies indicate that happiness and empathy could be critical for women, since offensive behaviour was the most reported negative aspect of their experience of ODS (with regard to gender dynamics), and more than half uninstalled Tinder due to an overall negative experience, while men were more likely to use Tinder for longer, even though boredom was the most frequent "negative" aspect of Tinder among men (see Chapter 4). Moreover, imbuing the application with the value of "privacy" and a "discreet" personality can also indicate a taboo around female sexuality and the need to "hide" their subscription to a dating application. In the design group, participants were more likely to prioritise the feeling of "safety" and, as noted before, to embed the app with an "honest" personality when the persona was perceived as a woman. Considering the comments of women users of Tinder and the concerns associated with with hookup culture (see chapter 2),

“safety” appears to address a women’s need to feel safe (the median for persona perceived as a woman was 1 – a very high priority) while using ODS for meeting new partners does not appear to be so important for men, since the overall median value for this item when the persona was perceived as a man was 4 on a scale of 1 (most important) to 8 (least important).

Women in the computer science group tended to assign a “cheerful” and “down to earth” personality to the application when designing for a man but not for a woman, suggesting they have a perception that men seek a joyful but informal form of interaction. This impression among women is in accordance with the study of women’s experience of Tinder (see Section 4.3, Chapter 4) in which interviewed women revealed their perception that men are looking more often for sex and less often for romantic relationships. Apart from the results for the persona perceived as a man and as a woman already discussed above, men in the design group were more likely to prioritise a “playful” interaction when designing for a man (median 1 - most important), which did not seem a priority for women designing for a woman (median 5 on a scale from 1 – most important – to 8 – least important). However, “pastime” was indicated as a motivation for using Tinder by 12% of the women users of Tinder (see Section 4.4, Chapter 4) and by none of the men users. When designing for a persona perceived as a man, men in the design group would prioritise the value of “honesty” more than women, who would in turn prioritise the value of “empowerment” more than men. The value of empowerment, however, was ranked low by both women and men in the design group (median 6 and 7, respectively), and thus, not considered an important value when designing for the persona perceived as a man.

5.4.3 Pooled data: differences between design and computer science groups

When analysing the two groups’s results in combination, regardless of participants’ college and background, it was possible to detect differences according to participants’ gender and persona’s gender. Men were more likely to prioritise a “calm” form of communication and to rate the “self-awareness” and “rate users” features higher than women. Men’s preference for calmness was already discussed above, and appears again when both groups are compared. The two features rated more highly by men refer to strategies to counteract a lack of self-perception and misbehaviour on ODS. This difference can indicate that men are more likely than women to embed the app with those two features that attempt to improve the experience of ODS. All participants combined were more likely to prioritise the feeling of “safety” and the value of “equality” when designing for a woman and to prioritise the feeling of “happiness” and values of “empathy” and “reciprocity” when designing for a man. A closer look at each persona revealed that men participating in the study were more likely to prioritise a “calm” form of communication through the app and the “relationship mode” feature. These differences are similar to those found in the computer science group alone, which were already discussed above. No differences between men and women emerged in the analysis of the persona perceived as a man in the combined data set.

It was possible to understand that many differences that emerged depended on participants’ background – whether in computer science or design. Computer science students were more likely to facilitate an “effective” form of communication, to embed the app with a “creative” and “intriguing” personality and to prioritise the

“self-awareness” feature, in comparison to design students. Design students, in turn, were more likely to embed the app with a value of “empathy”, a “polite” communication style, and an “honest” and “respectful” personality, in comparison to computer science students. These results reveal that design students were more committed to providing an interaction that would enhance good behaviours among users while computer science students were more committed to designing a more effective and appealing interaction.

Furthermore, gender differences among computer science participants were more expressive than among design participants with regard to the number of statistically significant differences and the level of significance of those differences. The number of elements that revealed differences between men and women were greater within the computer science group and some of those differences showed lower levels of significance in comparison to differences in the design group. In the four tests conducted within groups, significant differences were found for 16 design elements in the computer science group and 10 elements in the design group. The gender differences within the design group were limited to a significance level of 0.05, which indicates an estimate probability of 95% of rejecting the null hypothesis that there were no differences between the two genders. Within the computer science group, however, the significance levels in differences varied from 0.05 to 0.001, indicating an estimate probability of 95% to 99% of rejecting the null hypothesis. In other words, the number of differences is greater in the computer science group and some differences are more significant.

Gender in its plurality and complex nuances of masculinities and femininities can play a role in how gender differences are more or less evident in certain groups. As indicated by Faulkner (2006; 2011) engineering and information and communications technologies (ICTs) are fields in which the expression of masculinities and suppression of femininities configure women and determine their success to adapt to an environment dominated by men. The same was brought to light by Williams (2014) in relation to the computer science workplace culture. Moreover, technology fields may attract women that are more masculine and feel more comfortable in a masculine environment. If a more masculine mindset would lead to less differences between men and women in a group, than women in the design group would probably be more committed to “think like men” than women in the computer science group. Thus, this could explain the fact that less differences emerged between men and women in the design group in comparison to the computer science group. However, this is just one indicator of gender expression in workplace cultures, and more specific research would be necessary to understand whether this is the reason for differences among the two groups. It is possible that the opposite is also happening in design groups: that men are more fluid in expressing femininities that lead to less differences, contradicting with previous studies in the field.

With regard to gender biases, this study not only revealed differences in how men and women establish requirements for a project but also in how the perception of the persona being either a man or a woman lead to different requirements, even when the user described is a gender-neutral character. That is, given one single gender-neutral user, different requirements can be defined depending on the designer’s/developer’s gender or on the persona’s perceived gender. Moreover, this study also revealed differences with regard to participants’ background and showed that many gender differences depend on participants’ background.

5.5 Contributions, challenges, and constraints

This study indicated the existence of gender biases in design by means of statistical analysis. A positive outcome of this research could be the creation of tools such as a gender-neutral persona and scenario to improve gender awareness in the design process. It has been demonstrated that the neutral persona proved to be a feasible approach to design in terms of “realism”, but requires more research to evaluate the extent of its impact on design. Overall, this might lead to methods for counteracting the inscription of gender stereotypes in future designs.

There remain issues to be explored in order to improve the creation of neutral tools. First, the concept of “neutrality” can be approached in two different ways; a user and service description can be neutral in a way that merges both women, men and transgender users’ traits or in a way such that only needs common to all gender groups are included in the descriptions (only non-stereotyped traits that suit all users). In this study, the creation of a gender-neutral persona was limited to the second approach in which no specific gendered user needs are used in the construction of the persona and scenario descriptions.

This neutrality dichotomy also applies to the inclusion of gender differences when “inclusivity” is approached; persona and scenario descriptions, for example, can include requirements that are important for all groups or combine requirements that are important for each group but not for all. Despite the fact that all participants recruited to this study fell into a binary gender classification scheme, neutral tools can attend to a wider spectrum of genders since the idea is not to mark these descriptions with gendered traits, needs or perspectives. The idea behind the creation of gender-neutral tools is to improve gender inclusivity in a broad sense so that users’ needs can be met without a gender label.

The term “gender neutrality” has been used to refer to the absence of gender traits and stereotypes while “gender inclusivity” has been used to refer to the inclusion of gendered needs in projects. However, the inclusion of each gender’s needs can co-exist with the concept of “neutrality” and be incorporated into a neutral persona; that is, different groups’ needs can be met without emphasising gender as an explicit factor. Thus, a necessary next step is to explore the concept of gender neutrality and gender inclusivity in design tools. In this study, only one approach to neutrality was used, which relied on the removal of stereotyped ideas of woman’s and man’s personalities, rendering a description neutral by the absence of gender traits.

Further discussion of approaches to gender neutrality and the development of a technique to create gender neutral personas will help to improve design tools and the design process as a whole. A more focused exploration of gender-neutral personas is provided in the next chapter (see Chapter 6).

5.6 Conclusion

Many assumptions regarding gender biases in technological developments were posited in the past decades, including that gender stereotypes could be ingrained in products and services (Akrich, 1992; van Oost, 2003) and that a men’s domination in technology affects the design of products and services (Fountain, 2000; Wajcman,

2000). In order to explore the effects of gender in the development of technology in terms of these assumptions, it was essential to investigate whether there are gender differences in the decisions made by men and women in the design process that could support such claims.

The goal of this study was to reveal gender differences in design in order to move forward the discussion of gender bias and the creation of tools to counteract gender issues in the design process. However, to justify the creation of such tools, it was necessary to first explore the existence of gender bias in design and to understand whether this is an appropriate claim. There would be no purpose in creating such tools if men and women revealed no differences in assigning priorities during a project. A prior lack of research in this area made for the open question that underpins this study and this PhD research.

The results revealed here support the presence of gender-bias in design even when a persona and scenario with no gender traits are provided. 16 design elements revealed statistically significant differences between men and women studying computer science when taking decisions for the same user, and 10 statistically significant differences in the selection of design elements were detected in the decision making process of the design group. In both groups, the reported difficulty in making decisions for a user without taking personal preferences into account also provides support for the presence of gender bias in design. Yet the level of difficulty in avoiding personal bias has no interaction with gender: men and women are as likely to influence design with their own opinions. It is therefore possible that design projects which do not rely on user research are more likely to be biased by the team and decisions made based on designer's/developer's beliefs. This research also revealed that the majority of participants did not notice the absence of gender in user description, indicating that using gender-neutral personas may be an alternative means of engaging with user needs without emphasising gender. Moreover, these results showed differences with regard to participants' backgrounds. That is, differences distinct from gender bias emerged according to participants' backgrounds. While both computer science and design professionals develop concepts for mobile technology, the outcomes may prove different, regardless of gender.

Chapter 6

User study: the influence of personas' gender in design

6.1 Introduction

The user study on gender differences in design described in the previous chapter (see Chapter 5) revealed some differences in design decisions taken by women and men taking computer science and design courses. These differences highlighted gender as a factor which impacts the development of products and services. For that study, a gender-neutral persona was created as an attempt to remove the focus on gender during the design process. 78% of design students did not notice the suppression of gender in the user description and unconsciously assigned a gender to the persona, indicating that gender is not fundamental to understanding users' needs and taking decisions during the design process. The 22% that noticed the absence consciously assigned a gender to the persona, with the exception of one participant who did not assign any gender. All participants were able to engage with the persona and take decisions based on a genderless description, and the large majority did not even notice the absence of gender.

The gender-neutral persona employed in the study of gender bias was developed because it was necessary to neutralise gender traits in order to understand whether there were gender biases in the design process. Despite the achievement of that goal, this previous study indicated the feasibility of using a gender-neutral persona since participants were able to engage with the user regardless of gender, and that the gender-neutral approach could therefore possibly help to mitigate gender issues early in the design process – this is the hypothesis that is tested here. Hence, this previous study relies on the assumption that removing gender as an explicit quality of the description of personas would make it possible to merge different genders' needs into a single user description, and, accordingly, to avoid gender bias towards one single gender group's needs. However, a more detailed study was necessary to explore different ways of addressing neutrality in the description of personas, to merge gender needs, and to test the effect of gender-neutral personas. So far, in the last study, the creation of a gender-neutral persona was limited to the removal of gender traits, without the addition of any specific gendered user needs.

Moreover, to create that persona, it was necessary to adapt the scenario description, which is usually written in third person to a first person style in order to avoid the use of gendered pronouns such as “he” and “she”. From that experiment emerged the idea of exploring the impact of the use of first person pronouns in the persona description. It is known that men and women have different styles of writing, with women using more personal pronouns (first, second and third person) (Argamon, Koppel, Fine, & Shimoni, 2003),¹ prestige variants of language (Labov, 1990; Lakoff, 1973), and emphatic adjectives (Lakoff, 1973) than men.

For this reason, using a first person perspective could be a solution to the challenge of avoiding explicit references to gender in the description of personas, but at the same time could pose difficulties for a gender-neutral writing style, should the inflection be associated with a women. Outcomes for the ranking of design priorities using first person pronouns and no personal pronouns were compared. Descriptions in first person form comprised pronouns and verbs inflected for the first person perspective while descriptions in third person had pronouns removed and only the verbs inflected in third person. In this final study, the concept of neutrality is extended to merge masculine and feminine traits and gender-neutral personas are compared to regular gendered personas in order to bring about a better understanding of the application of the gender-neutral approach.

6.2 Research design

The research question that motivates this study is: “Can gender-neutral personas promote the inclusion of both women’s and men’s primary needs in a balanced way in the design process?”. In order to answer that question, an online survey was designed in which participants received one persona of a set of eight personas and rated design elements according to the description of that user. Results were compared in order to understand whether the decisions made for gender-neutral personas meet the needs of both personas, the woman and the man.

6.2.1 Study structure

This investigation of the impact of the neutral persona in the definition of requirements during the design of mobile applications was conducted through a design survey involving professionals in creative fields. Surveys are expected to be short (Blandford, Cox, & Cairns, 2008), and even shorter when conducted through online survey websites since people are more likely to get distracted by a concurrent activity and, consequently, to abandon the survey. This effect was noticed during recruitment for the first study of this thesis (see Section 4.3, Chapter 4), where 134 women volunteered to participate but only 40 completed the survey. Thus, the quicker the survey to complete the better the that participants will engage and retain focus before a distraction interrupts their participation. In order to provide a short survey with a duration no longer than 5 minutes, the first column (feelings) of the first task and the third task (features) of the previous study (see Chapter 5) were selected for replication in this new study.

¹Others have found that where there is no eye-contact in dialogue, this holds as well, but not where eye-contact is available (Vogel, Ribeiro Lopes, & Esposito, 2017).

6.2.2 Participants

Initially, a minimum of 120 participants were expected to take the survey (30 participants for each persona's gender type) to satisfy the applicability assumptions of statistical tests. Following recruitment, data was gathered from 158 professionals in creative fields: 93 women and 65 men aged between 22 and 55 years old. Surveys submitted with any blank task were erased. Of this sample, 150 were Brazilian professionals. The median and mean age of participants was 35 years old.

6.2.3 Recruitment

The recruitment of volunteers was conducted through Facebook and WhatsApp groups. The call briefly explained in a general post that volunteers were needed to respond to the survey, explained what the survey was about, and attached a link to Qualtrics. Participants did not receive any remuneration for participating. Personal relationships were leveraged to distribute the survey and to recruit participants. Those who expressed interest found detailed information for participants and the consent declaration in the first part of the survey.

6.2.4 Description

The survey was adapted to the Qualtrics web platform so that participants could respond online. It was expected that participants would take about 5 minutes to answer the questions. Those participants that provided consent to participate received textual instructions on how to answer the survey and perform the tasks. They were presented with a first set of questions concerning demographic information (gender, age, nationality, familiarity with design, and familiarity with dating apps). In the second portion of the survey, they found the two tasks selected from the previous study (see Figure 6.1). In the first task participants were asked to put in order of importance the "feelings" the persona (the user) was supposed to feel. There were eight different feelings to be sorted - the most important was to be positioned at the top and the least important at the bottom of the list. They used a drag and drop feature for ordering elements and each element was placed in a unique position within the rank (see Figure 6.1). In the second task, participants were presented with a list of twelve features to be rated: values ranged from 1 - not important - to 5 - definitely important. As explained in the previous study from which the tasks were selected, both feelings and features derived from the literature review on hookup culture (see chapter 2) and the initial studies involving Tinder users (see Chapters 4).

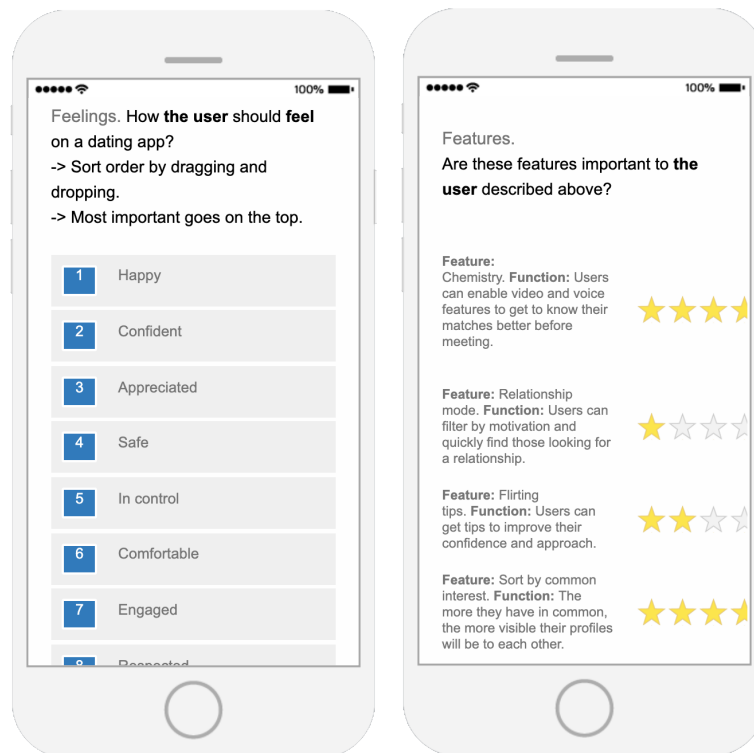


Figure 6.1: *The interface provided to participants for completing tasks 1 and 2 in the online survey.*

6.2.5 Ethics

This study was approved by the Research Ethics Committee of Trinity College Dublin prior to the recruitment of participants. Volunteers willing to participate found information about the research in the participant information sheet, which was presented prior to an informed consent page and preceded the survey at the Qualtrics link. They were not told that gender was being analysed since it could influence their decisions, but were given the option to receive a debriefing email with more information and results. They were told about their rights, that they would not receive any remuneration for participating, that the survey presented no risks, and that they would answer the survey anonymously (for the complete explanation provided to participants, see Appendix P). Those who agreed to the terms could proceed to the survey itself. Participants could withdraw at any time before submitting their answers, without any prejudice. Once they submitted their response, they could not withdraw anymore because the submission was anonymous and the identification of the survey response was no longer possible. Surveys that were not completed through the final submission button were deemed incomplete and incomplete surveys were automatically erased. Participants received this information in the first part of the survey, before consenting to the terms and gaining access to the questions.

6.2.6 Construction of personas: selection of masculine and feminine traits

In the first study of this PhD research, it was detected that women were very likely to feel disrespected during their interactions through Tinder, that they were primarily looking for friends, that few openly expressed looking for casual dates, that even fewer expressed being in search of sex, that the majority thought the developer was a man and that they felt that there was a difference between men's and women's motivations to use the application.

<i>Question</i>	Gendered categories of answer		
	<i>Women</i>	<i>Men</i>	<i>Both</i>
Q1 - motivations			hookup friendship relationship
Q3 - 1st impression	superficial		great
Q4 - 1st matches			confident
Q5 - match system	effective	superficial	inefficient OK
Q6 - benefit of use	romance	easy dates	friends
Q7 - downside	offenses too sexual people lie	boring bad situations	
Q8 - respect	no/not fully		yes
Q11 - reason to uninstall	negative experience		new relationship

Table 6.1: The selection of elements that describe women’s and men’s experiences of dating apps.

In addition to the findings of the first study, the second study, revealed that men were more likely than women to benefit from “easy dates setting” and to have a respectful experience, while women were more likely to perceive the application as “too sexual”² and “superficial”, that both felt confident using the application, and both benefited from getting to know new people through the application. Moreover, men and women shared the same opinion about the downside of the application, reporting finding it boring for its lack of dynamism, as well as untrustworthy for people would often lie about themselves, shared the same openness to different sorts of interaction (friendship, casual dates, long-term relationships), and the same perception that men are more often looking for sex while women are looking for a relationship, and that their experience would have been better if the matching system was more accurate and sensitive to their preferences since they felt the system was somehow inefficient.

The information collected in the subsequent study concerning gender differences on dating applications (see Section 4.4, Chapter 4) was crucial for creating the set of personas employed during this study. In order to address certain gender nuances that were not detected through statistical tests, it was necessary to select the most frequent answers in women’s and men’s groups for questions that would help in the construction of the set of personas based on women’s and men’s experiences of dating apps. Through this approach, it was possible to determine which categories were feminine or masculine and, moreover, identify categories common to both men and women (see Table 6.1). Not all of the questions posed in the study on gender differences in online dating experiences revealed information about elements that were more common to women, to men or to both. Hence, only those questions whose results revealed gender traits were used in the construction of the set of personas used in this study.

²Note that the perception of the application being “too sexual” in this study refers to the perception of a more direct sexual approach and of conversations directed towards sex.

6.2.7 The set of personas

In the previous study on gender bias in the design of dating applications (see Chapter 5), a gender-neutral persona was presented to participants. That neutral persona was designed with no gender traits and no specific gender needs. That persona description did not include the user experience of dating applications; it was a general description of everything else (tastes, aspirations, lifestyle...) but not the online dating experience. In that particular case it was beneficial not to reference the user experience, since it would be marked by gender traits, as indicated in the findings of the first study, and would give a gendered character to the description of the persona, which could influence participants' perceptions of the persona as representing a man or a woman. The idea of that study was to determine if participants would tend to assign one gender more than the other to the persona, and for that reason the persona was constructed without information about the previous experience of dating applications. However, in order to use the persona as a tool, it must merge gender traits, experiences, and needs into a single character; which is the idea tested in this study.

In order to explore the different approaches to gender-neutrality, two gender-neutral personas were designed for this study, in addition to two gendered personas (a woman and a man) grounded in the data provided by users in Chapter 4. Unlike the gender-neutral persona of the Chapter 5, which did not depict users' needs, the personas in this study introduced users' needs in two distinct approaches. Therefore, the set of personas used in this last study contained one woman, one man, and two gender-neutral personas written in third person and a variation of each persona written in first person. The two gender-neutral personas written in third person used no pronouns; only the verbs were inflected in third person so as not to assign a gender to those neutral personas. This created four gender types. One of the gender-neutral personas merged needs in common between women and men users, and the other merged needs that were exclusive to each gender. The two versions of each persona presented the same information, the only difference between the two is the inflection. For detailed information provided for each persona and its inflection variation, see Figures 6.2, 6.3, 6.4, and 6.5.

In order to distinguish between the two gender-neutral personas, the one that depicts overlapping elements (in common between women and men) will be referred to as the common gender-neutral persona and the one that mixes elements unique to women and elements unique to men will be referred to as the mixed gender-neutral persona. The personas were presented to participants as described in Table 6.2.

<i>Persona</i>	<i>Gender</i>	<i>Needs</i>	<i>Inflection</i>
Persona 1	Neutral	In common	3rd person
Persona 2	Neutral	In common	1st person
Persona 3	Neutral	Mixed	3rd person
Persona 4	Neutral	Mixed	1st person
Persona 5	Woman	Women	3rd person
Persona 6	Woman	Women	1st person
Persona 7	Man	Men	3rd person
Persona 8	Man	Men	1st person

Table 6.2: Summary of features introduced by personas

Persona 1 (Gender: Neutral / Needs: in common / Inflection: 3rd person):	
<p>City: Dublin, Ireland.</p> <p>Age: 22 years old.</p> <p>Education: B.A. in Law</p> <p>Work: legal intern</p> <p>Income: 22k/year</p> <p>Short-term goals: Share a flat with friends; Take tennis lessons.</p> <p>Long-term goals: Learn Spanish; Take guitar lessons; Open a family law firm.</p>	<p>Bio: Foodie, sports enthusiast and Ed Sheeran's cousin. Goes to the gym every weekday or so. A good weekend is full of outdoor activities with friends on sunny days or full of cooking and movies on rainy days. Enjoys travelling, but never thought about living abroad - there's no better place than Ireland. Meets friends for food and drinks every Thursday. Likes to spend time with family, watching movies and TV series together. Is a regular visitor to the national museums in Dublin and likes reading about history and historical movements.</p> <p>Dating app experience: When using a dating app was open to many things: to get to know people, to hook up and to find a partner for a relationship. Felt confident about installing the app and had a good first impression of it. Felt great with first matches, but in the long term found the match system somehow inefficient. The positive side of the experience was getting to know interesting people and making new friends. Often felt respected in the app, and only uninstalled it due to the start of a new relationship. Believes the experience would be better if matching was more accurate.</p>
Persona 2 (Gender: Neutral / Needs: in common / Inflection: 1st person):	
<p>City: Dublin, Ireland.</p> <p>Age: 22 years old.</p> <p>Education: B.A. in Law</p> <p>Work: legal intern</p> <p>Income: 22k/year</p> <p>Short-term goals: Share a flat with friends; Take tennis lessons.</p> <p>Long-term goals: Learn Spanish; Take guitar lessons; Open a family law firm.</p>	<p>Bio: I'm a foodie, a sports enthusiast and Ed Sheeran's cousin. I go to the gym every weekday or so. A good weekend for me is full of outdoor activities with friends on sunny days or full of cooking and movies on rainy days. I enjoy travelling, but I've never thought about living abroad - there's no better place than Ireland. I meet friends for food and drinks every Thursday and I like to spend time with my family, watching movies and TV series together. I'm a regular visitor to the national museums in Dublin and I like to read about history and historical movements.</p> <p>Dating app experience: When using a dating app I was open to many things: to get to know people, to hook up and to find a partner for a relationship. I felt confident about installing the app and had a good first impression of it. I felt great with my first matches, but in the long term I found the match system somehow inefficient. The positive side of my experience was getting to know interesting people and making new friends. I often felt respected in the app, and I only uninstalled it due to the start of a new relationship. I believe I would have had a better experience if matching was more accurate.</p>

Figure 6.2: *Personas with needs in common between men and women: 1st and 3rd person inflection.*

Persona 3 (Gender: Neutral / Needs: exclusive mixed / Inflection: 3rd person):	
<p>City: Dublin, Ireland.</p> <p>Age: 22 years old.</p> <p>Education: B.A. in Law</p> <p>Work: legal intern</p> <p>Income: 22k/year</p> <p>Short-term goals: Share a flat with friends; Take tennis lessons.</p> <p>Long-term goals: Learn Spanish; Take guitar lessons; Open a family law firm.</p>	<p>Bio: Foodie, sports enthusiast and Ed Sheeran’s cousin. Goes to the gym every weekday or so. A good weekend is full of outdoor activities with friends on sunny days or full of cooking and movies on rainy days. Enjoys travelling, but never thought about living abroad - there’s no better place than Ireland. Meets friends for food and drinks every Thursday. Likes to spend time with family, watching movies and TV series together. Is a regular visitor to the national museums in Dublin and likes reading about history and historical movements.</p> <p>Dating app experience: When using a dating app, found the match system too superficial, although it was somehow effective. The positive side of the experience was easily arranging dates and finding partners for a relationship. However, felt offended by receiving unwanted sexual messages or pictures and sexist remarks, the approach was way too sexual, there were many fake profiles, people would very often lie about their relationship status and age. Felt bored because the same conversation seemed to happen with each match and few interesting people appeared among matches. Also experienced some unpleasant situations during encounters. Most of the time did not feel respected, and ended up uninstalling the app because felt demotivated and frustrated by it.</p>
Persona 4 (Gender: Neutral / Needs: exclusive mixed / Inflection: 1st person):	
<p>City: Dublin, Ireland.</p> <p>Age: 22 years old.</p> <p>Education: B.A. in Law</p> <p>Work: legal intern</p> <p>Income: 22k/year</p> <p>Short-term goals: Share a flat with friends; Take tennis lessons.</p> <p>Long-term goals: Learn Spanish; Take guitar lessons; Open a family law firm.</p>	<p>Bio: I’m a foodie, a sports enthusiast and Ed Sheeran’s cousin. I go to the gym every weekday or so. A good weekend for me is full of outdoor activities with friends on sunny days or full of cooking and movies on rainy days. I enjoy travelling, but I’ve never thought about living abroad - there’s no better place than Ireland. I meet friends for food and drinks every Thursday and I like to spend time with my family, watching movies and TV series together. I’m a regular visitor to the national museums in Dublin and I like to read about history and historical movements.</p> <p>Dating app experience: When using a dating app I found the match system too superficial, although it was somehow effective. The positive side of my experience was easily arranging dates and finding partners for a relationship. However, I felt offended by receiving unwanted sexual messages or pictures and sexist remarks, the approach was way too sexual, there were many fake profiles, people would very often lie about their relationship status and age, I felt bored because the same conversation seemed to happen with each match and few interesting people appeared among matches, and I also experienced some unpleasant situations during encounters. Most of the time I did not feel respected, and I ended up uninstalling the app because I felt demotivated and frustrated by it.</p>

Figure 6.3: *Personas with elements unique to women and elements unique to men combined: 1st and 3rd person inflection.*

Persona 5 (Gender: female / Needs: female / Inflection: 3rd person):	
<p>City: Dublin, Ireland.</p> <p>Age: 28 years old.</p> <p>Studied: B.A. Digital marketing</p> <p>Work: Customer experience professional</p> <p>Income: 30k/year</p> <p>Short-term goals: Start an online business; Take tennis lessons.</p> <p>Long-term goals: Learn Spanish; Adopt a digital nomad lifestyle.</p>	<p>Bio: Clara is 28 years old and lives in a shared flat in the city centre. She works remotely for a company in Germany. She is not a sports enthusiast, but she likes to use a bike to get around the city. She enjoys travelling to exotic countries and experiencing new cultures. In her spare time she is learning how to play the guitar and improving her English. She also likes to visit art galleries and museums.</p> <p>Dating app experience: While using a dating app, she mainly wanted to get to know people and to find a partner for a relationship. She felt confident about installing the app but found it superficial. She felt great with the first matches, but in the long term she found the match system somehow inefficient. The positive side of the experience for her was getting to know interesting people and to find partners for a relationship. However, her experience was marked by offensive behaviour from other users (such as a not wanted sexual pictures or messages and sexist remarks), she felt the approach was way too sexual, there were many fake profiles, and people would very often lie about their relationship status and age. Most of the time she did not feel respected. She ended up uninstalling the app for feeling demotivated and frustrated by it. She believes that she would have had a better experience if matching was more accurate.</p>
Persona 6 (Gender: female / Needs: female / Inflection: 1st person):	
<p>City: Dublin, Ireland.</p> <p>Age: 28 years old.</p> <p>Studied: B.A. Digital marketing</p> <p>Work: Customer experience professional</p> <p>Income: 30k/year</p> <p>Short-term goals: Start an online business; Take tennis lessons.</p> <p>Long-term goals: Learn Spanish; Adopt a digital nomad lifestyle.</p>	<p>Bio: My name is Clara. I'm 28 years old, I share a flat with friends in the city centre, and work remotely for a company in Germany. I'm not a sports enthusiast, but I like to use a bike to get around the city. I love to travel to exotic countries and to experience new cultures. In my spare time I'm learning to play the guitar and improving my English. I also like to visit art galleries and museums.</p> <p>Dating app experience: When using a dating app I wanted to get to know people and to find a partner for a relationship. I felt confident about installing the app but I found it superficial. I felt great with my first matches, but in the long term, I found the match system somehow inefficient. The positive side of my experience was getting to know interesting people and finding partners for a relationship. However, I felt offended by receiving unwanted sexual messages or pictures and sexist remarks, I felt the approach was way too sexual, there were many fake profiles and people would very often lie about their relationship status and age. Most of the time I did not feel respected and I ended up uninstalling the app for feeling demotivated and frustrated by it. I believe I would have had a better experience if matching was more accurate.</p>

Figure 6.4: *Personas based on women's needs: 1st and 3rd person inflections.*

Persona 7 (Gender: male / Needs: male / Inflection: 3rd person):	
<p>City: Dublin, Ireland.</p> <p>Age: 22 years old.</p> <p>Studied: B.A. in Law</p> <p>Work: Legal intern</p> <p>Income: 22k/year</p> <p>Short-term goals: Share a flat with friends; Get promoted at work.</p> <p>Long-term goals: Perform at music festivals; Open a family law firm.</p>	<p>Bio: Peter is 22 years old and lives in his parents' flat. He works as a legal intern during the week and at music festivals for few weekends in the summer. He enjoys travelling whenever possible. He goes to the gym every weekday or so. He likes to cycle, to hike and to swim in the sea. In his spare time he likes to hang out with friends and to play with his band.</p> <p>Dating app experience: While using a dating app, he mainly wanted to get to know people and to go on casual dates. He felt confident about installing the app and felt great with the first matches, but in the long term, he found the match system somehow superficial. The positive side of the experience for him was getting to know interesting people and easily arranging dates. However, he felt bored using the app (the same conversation seemed to happen with each match and few interesting people appeared among matches) and experienced some unpleasant situations during encounters. In general, he felt always respected. He ended up uninstalling the app due to the start of a new relationship. He believes that he would have had a better experience if matching was more accurate.</p>
Persona 8 (Gender: male / Needs: male / Inflection: 1st person):	
<p>City: Dublin, Ireland.</p> <p>Age: 22 years old.</p> <p>Studied: B.A. in Law</p> <p>Work: Legal intern</p> <p>Income: 22k/year</p> <p>Short-term goals: Share a flat with friends; Get promoted at work.</p> <p>Long-term goals: Perform at music festivals; Open a family law firm.</p>	<p>Bio: My name is Pedro. I'm 22 years old, I live in my parents' flat, I work in a restaurant during the week and occasionally in music festivals for few weekends in the summer. I like to travel whenever possible. I go to the gym every weekday or so. I like to cycle, to hike and to swim in the sea. In my spare time I also hang out with my friends and play with my band.</p> <p>Dating app experience: While using a dating app I mainly wanted to get to know people and to go on casual dates. I felt confident about installing the app and felt great with my first matches, but in the long term, I found the match system somehow superficial. The positive side of my experience was getting to know interesting people and easily arranging dates. However, I felt bored using the app (the same conversation seemed to happen with each match and few interesting people appeared among matches) and I also experienced some unpleasant situations during encounters. In general, I felt always respected. I ended up uninstalling it due to the start of a new relationship. I believe I would have had a better experience if matching was more accurate.</p>

Figure 6.5: *Personas based on men's needs: 1st and 3rd person inflections*

6.2.8 Method of analysis

In order to verify whether gender-neutral personas promote the inclusion of women's and men's needs in a balanced way in the assignment of priorities in a design project, it was necessary to compare the priority ordering for each persona and the value (of importance) given to each element in each persona. Kendall's tau correlation was used to compare the elements' ordering, as it is an appropriate test to verify statistically significant similarities between two ranks. The Wilcoxon test was used to detect significant differences between the rank sum of two different personas for each design element. Here are the steps followed to analyse the data produced by participants for the eight personas:

Step 1: The first step in the analysis consisted in detecting the medians and means of design elements in the two tasks for each persona and sorting the ranks by order of medians and means. The ranks in task 1 were organised from 1 to 8, and the ranks in task 2 in a reverse rationale, from 5 to 1. Participants' data were organised in a spreadsheet with the scores given to each element in the two tasks. Means and median were calculated for each element in the two tasks of each persona, separately. Ranks were established by sorting the medians and means for each task of each persona. For a comparison between participants' gender, ranks were also created

with the scores for women and men participants for each task and persona (see Figures 6.6 and 6.7). The data ranks were sorted by medians, but elements with identical medians were subsequently sorted by means. Thus, a sorting by medians was prioritised over a sorting by means, which were only used to disambiguate medians with identical values. Values were assigned for each element's position in the ranks in order to compare the ranks using the Kendall's tau correlation.

A value of 1 was assigned to an element positioned in the top of the rank for task 1, which had the lowest mean since values range from 1 for the most important element and 8 for the least important element. The same applies for the ranks that refer to task 2 with regard to the values from the top to the bottom according to the position in the rank. However, it is useful to recall that the rank means were previously organised in a reverse order in task 2: elements with higher means were positioned on the top of the rank list and those with lower means were positioned at the bottom of the rank list.

Step 2: The ranks of the two gendered personas (woman and man), and two gender-neutral personas were compared using Kendall's tau correlation. Different ranks were generated according to the variable being analysed: participants' gender, persona and person inflection. The greater the correlation coefficient, the stronger the correlation between two ranks. A strong correlation indicates that more items within the ranks are correlated. That is, the ranks are similar from a statistical point of view, even if they present some slight differences in the ordering and different values are given to each element of the rank.

Step 3: In the analysis of the ranks according to personas, each element within the ranks was compared separately using a Wilcoxon test in order to detect significant differences within the ranks. Since Kendall's tau correlation only compares the position of the elements in the rank, it was necessary to analyse whether there are differences in the distribution of the values assigned to each element, similarly to the tests carried out in the study on gender bias in development (see Chapter 5). Each element of the rank list in task 1 and task 2 was isolated and analysed, one at a time. Values for that element were compared between two personas, in pairs. In the analysis of the ranks according to participants' gender, the ranks for each task were split into two, one for women participants and one for men participants.

Step 4: To verify whether the neutral personas include both gendered (woman and man) personas' top priorities, it was necessary to understand which feelings and features were rated as the most important elements for each persona. For the task 1, medians between 1 and 3 were defined as high priority, medians between 4 and 5 as medium priority, and medians higher than 5 as low priority. For task 2, medians higher than 4 were defined as high priority, medians between 3 and 4 as medium priority, and medians lower than 3 as low priority. Thus, the elements within the ranks were divided into 3 categories of priority: of high, medium and low priority (see Figures 6.6 and 6.7 to visualise the categorisation). By only isolating the high priority elements, it was possible to detect which of the woman's and man's high priorities were displayed as high priority in the neutral personas.

Through these four steps it was possible to analyse the data generated for this study and compare the personas' ranks. Several possible outcomes were expected from this study. One possibility was that personas' priorities would be the same. Another possibility was that the gendered personas' priorities would differ but the gender-neutral personas would not merge the two groups' priorities in a balanced way, but rather include one

group's priorities more than the other. It was also expected that ranks could reveal that either common or mixed gender-neutral personas would be more effective than the other in merging women's and men's priorities in a balanced way. With regard to the use of 1st person and 3rd person styles in textual descriptions of personas, it was expected that inflections could either produce differences or not in the rankings. The analysis of differences between descriptions written in first and third person consisted in the comparison of the ranks produced for each inflection within the gendered (woman and man) personas' ranks in order to test whether there exists a perception of the personas written in first person as representing a woman. Through the Wilcoxon test it was also possible to detect differences in assigning priorities to gender-neutral personas according to person inflections.

6.3 Results

6.3.1 Test 1: Differences between personas

The resulting rank order for task 1 and task 2 are displayed in Figures 6.6 and 6.7, respectively. The results show that there are significant correlations between all the ranks in both task 1 and task 2, indicating that the ordering of priorities of all personas are similar. A comparison between ranks for task 1 using Kendall's tau correlation (see Figure 6.8) shows that both Peter's and Clara's ranks are more similar to the common neutral persona's rank than to the mixed neutral persona's rank. The strongest correlations for task 1, however, are between Clara's and Peter's ranks and between Clara's and the common neutral persona's ranks. The least significant correlations are between Peter's and the mixed neutral personas' ranks and between the two neutral personas. With regard to task 2 (see Figure 6.9), Peter's rank is more strongly correlated with the common persona's rank while Clara's rank is more strongly correlated with the mixed persona's rank. The strongest correlation is between Clara's and the mixed persona's ranks. The least significant correlation is between Peter's and the mixed persona's ranks.

Task 1: Data ranked by medians and means											
Persona: Peter			Persona: Clara			Persona: Mixed			Persona: Common		
Feelings	M	μ	Feelings	M	μ	Feelings	M	μ	Feelings	M	μ
Safe	2	2.93	Safe	2	3.16	Respected	2	2.85	Safe	2	2.92
Respected	4	3.67	Respected	3	3.33	Safe	2	2.87	Comfortable	3	3.23
Comfortable	4	3.93	Comfortable	3	3.72	Comfortable	4	3.90	Respected	3	3.68
Happy	4	4.09	Confident	5	4.33	Appreciated	4	4.56	Confident	4.5	4.50
Confident	4	4.44	Happy	5	4.44	Confident	5	4.68	Happy	5	4.65
Appreciated	5	4.41	Appreciated	6	5.08	In control	5	4.87	Appreciated	5	4.76
In control	6	5.41	In control	6	5.08	Happy	5	4.90	In control	5	5.10
Engaged	8	7.09	Engaged	8	6.83	Engaged	8	7.31	Engaged	8	7.07

■ median (M) ≤ 3
 ■ median (M) 4-5
 ■ median (M) > 5

Figure 6.6: Ranks for Task 1: data ordered by medians and means values.

Task 2: Data ranked by medians and means												
Persona: Peter			Persona: Clara			Persona: Mixed			Persona: Common			
Features	M	μ	Features	M	μ	Features	M	μ	Features	M	μ	
Common interests	5	4.54	Relationship mode	5	4.47	Relationship mode	5	4.51	Common interests	5	4.44	
Join a group	4	4.06	Stay safe	5	4.03	Stay safe	5	4.46	Stay safe	4.5	3.78	
Relationship mode	4	3.90	Common interests	5	4.25	Common interests	5	4.41	Relationship mode	4	3.95	
Stay safe	4	3.81	Rate users	4.5	4.13	Rate users	5	4.17	Join a group	4	3.94	
Rate Users	4	3.79	Join a group	4	3.94	Join a group	4	3.95	Chemistry	4	3.91	
Chemistry	4	3.76	Chemistry	4	3.72	Chemistry	4	3.70	Rate users	4	3.65	
Self awareness	3	3.23	Self awareness	4	3.50	Self awareness	3	3.17	Self awareness	3	3.21	
Smart move	3	2.95	Match boost	3	2.86	Match boost	3	2.80	Match boost	3	2.86	
Match boost	3	2.93	Smart move	3	2.75	Flirting tips	3	2.75	Smart move	3	2.84	
Flirting tips	3	2.47	Flirting tips	3	2.69	Smart move	3	2.73	Flirting tips	2	2.42	
Time is ticking	2	2.71	Time is ticking	2.5	2.55	Time is ticking	3	2.67	Time is ticking	2	2.08	
Gift voucher	2	2.04	Gift voucher	2	2.38	Gift voucher	2	2.35	Gift voucher	1	2.02	

median (M) > 4
 median (M) 3-4
 median (M) < 3

Figure 6.7: Ranks for Task 2: data ordered by medians and means values.

Correlations

		PETER_T1	CLARA_T1	MIXED_T1	COMMON_T1	
Kendall's tau_b	PETER_T1	Correlation Coefficient	1.000	.929**	.643*	.857**
		Sig. (2-tailed)	.	.001	.026	.003
		N	8	8	8	8
	CLARA_T1	Correlation Coefficient	.929**	1.000	.714*	.929**
		Sig. (2-tailed)	.001	.	.013	.001
		N	8	8	8	8
	MIXED_T1	Correlation Coefficient	.643*	.714*	1.000	.643*
		Sig. (2-tailed)	.026	.013	.	.026
		N	8	8	8	8
	COMMON_T1	Correlation Coefficient	.857**	.929**	.643*	1.000
		Sig. (2-tailed)	.003	.001	.026	.
		N	8	8	8	8

**. Correlation is significant at the 0.01 level (2-tailed).
 *. Correlation is significant at the 0.05 level (2-tailed).

Figure 6.8: Kendall's tau correlation for personas' Task 1 ranks.

Correlations

			PETER_T2	CLARA_T2	MIXED_T2	COMMON_T2
Kendall's tau_b	PETER_T2	Correlation Coefficient	1.000	.818**	.788**	.848**
		Sig. (2-tailed)	.	.000	.000	.000
		N	12	12	12	12
	CLARA_T2	Correlation Coefficient	.818**	1.000	.970**	.848**
		Sig. (2-tailed)	.000	.	.000	.000
		N	12	12	12	12
	MIXED_T2	Correlation Coefficient	.788**	.970**	1.000	.818**
		Sig. (2-tailed)	.000	.000	.	.000
		N	12	12	12	12
	COMMON_T2	Correlation Coefficient	.848**	.848**	.818**	1.000
		Sig. (2-tailed)	.000	.000	.000	.
		N	12	12	12	12

** . Correlation is significant at the 0.01 level (2-tailed).

Figure 6.9: Kendall's tau correlation for persons' Task 2 ranks.

The correlations between high priorities are shown in the Figure 6.10. Considering results for tasks 1 and 2 together, the mixed persona presents six high priorities, the common persona five, Peter two and Clara seven. In task 1, the mixed persona comprises the single feeling rated as high for Peter and two of the three feelings rated high for Clara. The common persona, in turn, comprises the feeling rated as high for Peter and all three feelings rated as high for Clara. Thus, the mixed persona encompasses two of the three feelings rated high among the two groups and the common persona encompasses three of the three feelings rated high. In task 2, the mixed persona comprises the single feature rated high for Peter and all the four features rated high for Clara. The common persona, in turn, comprises the feature rated high for Peter and two of the four features rated high for Clara. Hence, the mixed persona encompasses all four features rated high among the two groups while the common persona encompasses two. Peter's high priorities coincide with both the mixed and common personas for the two tasks.

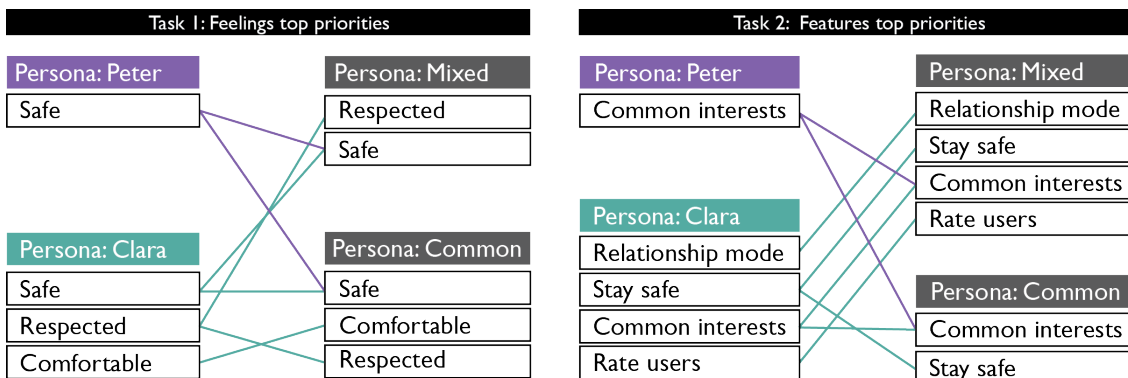


Figure 6.10: Correlation between personas' top rated elements of tasks 1 and 2.

The analysis of individual elements within the ranks through Wilcoxon test revealed that, between Peter and Clara, there was a significant difference for the "relationship" feature, which was rated higher for Clara. Between Peter and the mixed gender-neutral one, there were significant differences with regard to feeling "respected" and

to the “relationship” and the “stay safe” features. All the three elements were considered more important for the mixed persona. Between Clara and the common gender-neutral persona, there is a significant difference for the “relationship” feature, which was preferred for Clara. Between the common and the mixed gender-neutral personas, there is a significant difference for the “relationship” feature, which was preferred for the mixed gender-neutral persona, and differences approaching significance for feeling “respected” and the “stay safe” feature. No significant differences were found by comparing Peter and the common gender-neutral persona, or by comparing Clara and the mixed gender-neutral persona. See Table 6.3 for significant differences and differences approaching significance between the personas in the set. For a closer look at the distribution of the data for each of those elements and personas, see Figure Q.1 in the Appendix Q.

<i>Task</i>	<i>Personas' Pair</i>	<i>Element</i>	<i>P-value</i>	<i>Prioritised for</i>
Task 1	Peter X Mixed	Respected (feeling)	0.03*	Mixed persona
Task 1	Common X Mixed	Respected (feeling)	0.050	Mixed persona
Task 2	Clara X Peter	Relationship (feature)	0.024*	Clara
Task 2	Peter X Mixed	Relationship (feature)	0.009**	Mixed persona
Task 2	Peter X Mixed	StaySafe (feature)	0.007**	Mixed persona
Task 2	Clara X Common	Relationship (feature)	0.042*	Clara
Task 2	Common X Mixed	Relationship (feature)	0.019*	Mixed persona
Task 2	Common X Mixed	StaySafe (feature)	0.052	Mixed persona

Table 6.3: Differences in priority setting for personas in tasks 1 and 2, according to personas’ gender. Statistical significance in the difference as a function of the perceived importance of each element, assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

6.3.2 Test 2: Differences between personas by participants’ gender

The rank orders for task 1 and task 2 according to participants’ gender are displayed in Figures 6.11 and 6.12, respectively. The results for the comparison between women participants and men participants ranks using Kendall’s tau correlation for each task and each persona are displayed in Figures 6.13 and 6.14. The Kendall’s tau correlation test shows that men’s and women’s ranks are statistically similar for each persona in task 1 and 2, except for men’s and women’s judgments for the common neutral persona in task 1 that do not reveal similarities. Thus, in general, the order of elements coincide for many elements ranked in each task and for each persona. For the common persona in task 1, however, some major differences appear. For example, the feeling of “respect” drops from the 3rd position in the rank produced by women to the 7th position in men’s ranks, and the feeling of being “in control” rises from the 7th position in the women’s rank to the 4th position in the men’s (see Figure 6.11). Furthermore, despite the statistical similarity between the ranks produced by women and men for the common persona in task 2, a large difference in positions appears for some elements, such as the “chemistry” feature that rises from 5th position in the women’s rank to 1st in the men’s one or the “match boost” that drops from 7th in the women’s rank to 11th in the men’s (see Figure 6.12).

Comparison between the distribution of values between women and men participants was conducted using a Wilcoxon test (see Table 6.4). In task1, it was revealed that men were more likely than women to prioritise the

“happy” feeling for Peter and the “appreciated” and “in control” feelings for the common neutral persona, while women were more likely to prioritise the “respected” feeling for the common neutral persona, in comparison to men. In task 2, women were more likely than men to prioritise the “stay safe” and “time is ticking” features when designing for Clara and the “match boost” feature when designing for the common neutral persona. Men, in turn, were more likely than women to prioritise the “chemistry” feature when designing for the common neutral persona, in comparison to women. For the complete record of differences between personas according to participants’ gender using the Wilcoxon test, see Figure R.2 in Appendix R.

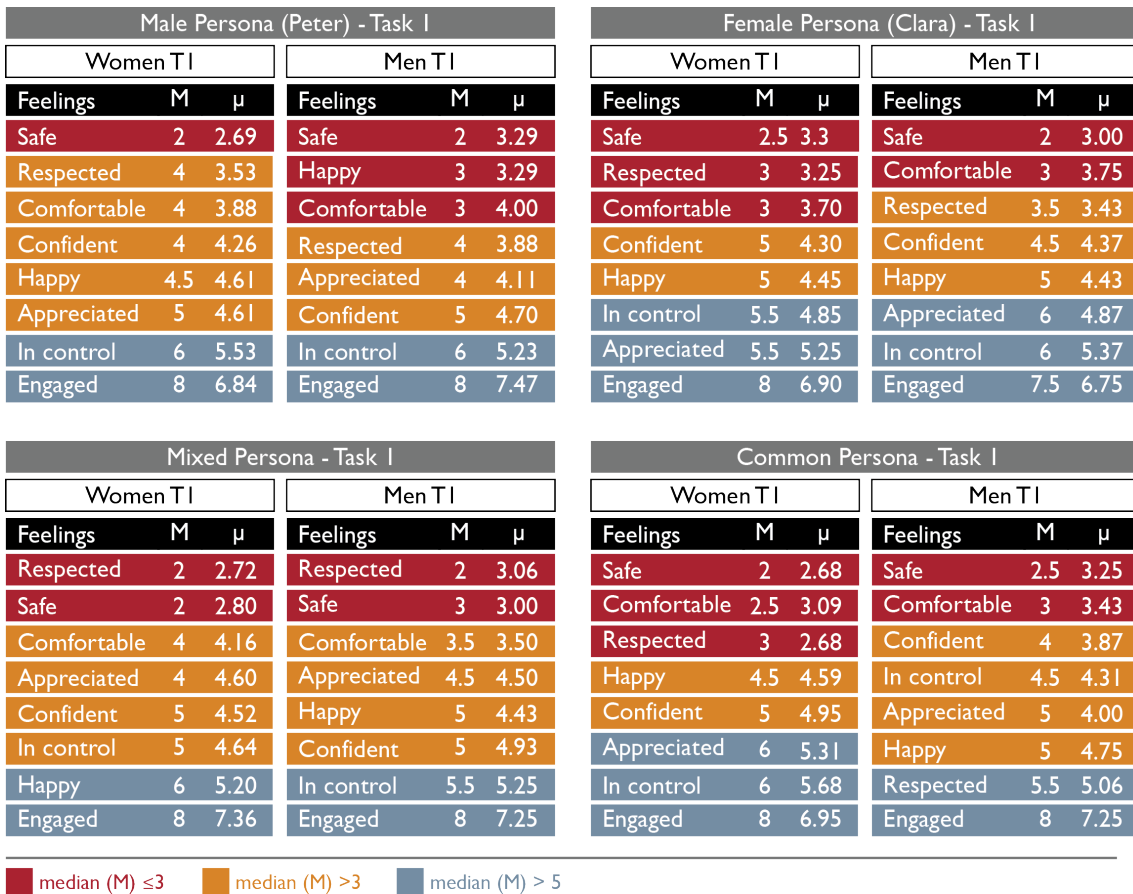


Figure 6.11: Correlation between women's and men's ratings for task 1.

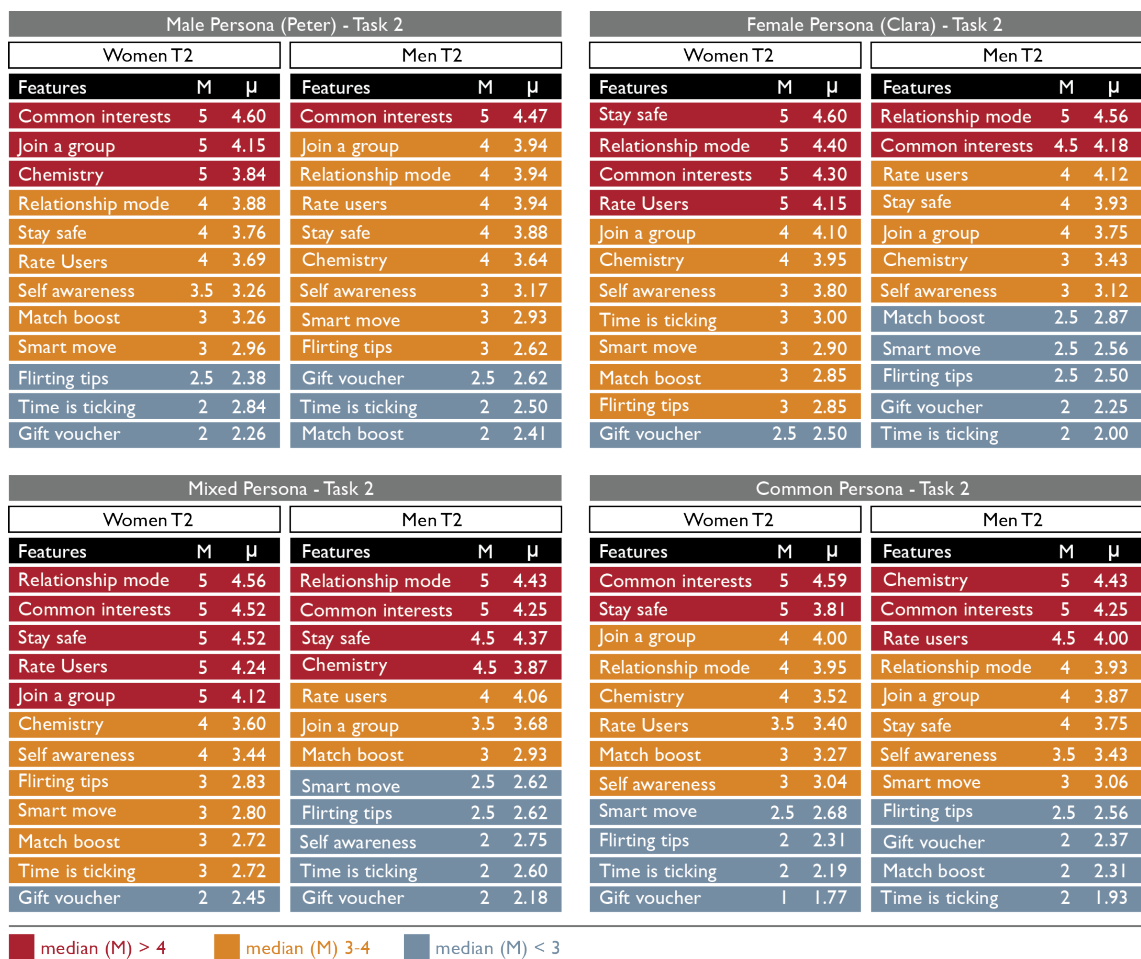


Figure 6.12: Correlation between women's and men's ratings for task 2.

Correlations

		Women Peter_T1	Men Peter_T1	Women Clara_T1	Men Clara_T1	Women Mixed_T1	Men Mixed_T1	Women Common_T1	Men Common_T1
Women Peter_T1	Correlation	1.000	.643 [*]	.929 ^{**}	.929 ^{**}	.714 [*]	.714 [*]	.857 ^{**}	.429
	Sig.	.	.026	.001	.001	.013	.013	.003	.138
	N	8	8	8	8	8	8	8	8
Men Peter_T1	Correlation	.643 [*]	1.000	.571 [*]	.714 [*]	.500	.643 [*]	.786 ^{**}	.357
	Sig.	.026	.	.048	.013	.083	.026	.006	.216
	N	8	8	8	8	8	8	8	8
Women Clara_T1	Correlation	.929 ^{**}	.571 [*]	1.000	.857 ^{**}	.643 [*]	.643 [*]	.786 ^{**}	.500
	Sig.	.001	.048	.	.003	.026	.026	.006	.083
	N	8	8	8	8	8	8	8	8
Men Clara_T1	Correlation	.929 ^{**}	.714 [*]	.857 ^{**}	1.000	.643 [*]	.643 [*]	.929 ^{**}	.500
	Sig.	.001	.013	.003	.	.026	.026	.001	.083
	N	8	8	8	8	8	8	8	8
Women Mixed_T1	Correlation	.714 [*]	.500	.643 [*]	.643 [*]	1.000	.857 ^{**}	.571 [*]	.429
	Sig.	.013	.083	.026	.026	.	.003	.048	.138
	N	8	8	8	8	8	8	8	8
Men Mixed_T1	Correlation	.714 [*]	.643 [*]	.643 [*]	.643 [*]	.857 ^{**}	1.000	.714 [*]	.286
	Sig.	.013	.026	.026	.026	.003	.	.013	.322
	N	8	8	8	8	8	8	8	8
Women Common_T1	Correlation	.857 ^{**}	.786 ^{**}	.786 ^{**}	.929 ^{**}	.571 [*]	.714 [*]	1.000	.429
	Sig.	.003	.006	.006	.001	.048	.013	.	.138
	N	8	8	8	8	8	8	8	8
Men Common_T1	Correlation	.429	.357	.500	.500	.429	.286	.429	1.000
	Sig.	.138	.216	.083	.083	.138	.322	.138	.
	N	8	8	8	8	8	8	8	8

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 6.13: Kendall's tau correlation between women's and men's ratings for task 1.

Correlations

		Women Common_T2	Men Common_T2	Women Mixed_T2	Men Mixed_T2	Women Clara_T2	Men Clara_T2	Women Peter_T2	Men Peter_T2
Women Common_T2	Correlation	1.000	.545*	.727**	.788**	.697**	.758**	.848**	.697**
	Sig.	.	.014	.001	.000	.002	.001	.000	.002
	N	12	12	12	12	12	12	12	12
Men Common_T2	Correlation	.545*	1.000	.636**	.576**	.485*	.667**	.697**	.727**
	Sig.	.014	.	.004	.009	.028	.003	.002	.001
	N	12	12	12	12	12	12	12	12
Women Mixed_T2	Correlation	.727**	.636**	1.000	.758**	.788**	.848**	.697**	.727**
	Sig.	.001	.004	.	.001	.000	.000	.002	.001
	N	12	12	12	12	12	12	12	12
Men Mixed_T2	Correlation	.788**	.576**	.758**	1.000	.667**	.788**	.697**	.545*
	Sig.	.000	.009	.001	.	.003	.000	.002	.014
	N	12	12	12	12	12	12	12	12
Women Clara_T2	Correlation	.697**	.485*	.788**	.667**	1.000	.758**	.606**	.636**
	Sig.	.002	.028	.000	.003	.	.001	.006	.004
	N	12	12	12	12	12	12	12	12
Men Clara_T2	Correlation	.758**	.667**	.848**	.788**	.758**	1.000	.727**	.758**
	Sig.	.001	.003	.000	.000	.001	.	.001	.001
	N	12	12	12	12	12	12	12	12
Women Peter_T2	Correlation	.848**	.697**	.697**	.697**	.606**	.727**	1.000	.727**
	Sig.	.000	.002	.002	.002	.006	.001	.	.001
	N	12	12	12	12	12	12	12	12
Men Peter_T2	Correlation	.697**	.727**	.727**	.545*	.636**	.758**	.727**	1.000
	Sig.	.002	.001	.001	.014	.004	.001	.001	.
	N	12	12	12	12	12	12	12	12

*. Correlation is significant at the 0.05 level (2-tailed).

** . Correlation is significant at the 0.01 level (2-tailed).

Figure 6.14: Kendall's tau correlation between women's and men's ratings for task 2.

Task	Persona	Element	P-value	Prioritised by
Task 1	Common	Appreciated (feeling)	0.045*	Men participants
Task 1	Common	In control (feeling)	0.017*	Men participants
Task 1	Common	Respected (feeling)	0.001**	Women participants
Task 1	Peter	Happy (feeling)	0.039*	Men participants
Task 2	Clara	Stay Safe (feature)	0.019*	Women participants
Task 2	Clara	Time is Ticking (feature)	0.017*	Women participants
Task 2	Common	Chemistry (feature)	0.010*	Men participants
Task 2	Common	Match Boost (feature)	0.047*	Women participants

Table 6.4: Differences in priority setting for each persona in task 1 and 2, according to participants' gender. Statistical significance in the difference as a function of the perceived importance of each element, assessed using the Wilcoxon test is indicated with asterisks (* – $p < 0.05$; ** – $p < 0.01$; *** – $p < 0.001$).

6.3.3 Test 3: Differences between personas by inflection

With regard to the person inflections used in the descriptions of the gender-neutral personas, the ranks produced for the first and third person inflections within each gender-neutral persona were compared with the Clara's and Peter's ranks (see Figures 6.6 and 6.7) in order to understand whether the use of the first person inflection would imply more feminine qualities, since the use of pronouns is a feminine marker and the third person inflection is used with no pronouns. Kendall's tau correlation revealed that the ranks produced for the gender-neutral

personas written in first person are more similar to Clara’s rank in task 1 (see Figure 6.15). The same effect does not occur in task 2: the rank produced for the mixed gender-neutral persona written in first person is more similar to Peter’s rank, and the rank produced for the common gender-neutral persona written in first person is equally similar to Peter’s and Clara’s ranks (see Figure 6.16). The comparison between priorities set for the gender-neutral personas written in first person (see Figure 6.17) and the priorities established for Clara and Peter reveals that the same priorities were set for the gender-neutral personas written in third and first persons in task 1, and that the ranks produced for the gender-neutral personas written in third person (see Figure 6.17) have more priorities in common with Clara than the ranks produced for the gender-neutral personas written in first person in task 2.

A comparison between writings in third and first person revealed that, for Clara, feeling “comfortable” was prioritised when the description was written in third person and feeling “happy” when the persona was presented in first person. For the common gender-neutral persona, feeling “appreciated” was prioritised when description was in first person form and the feature “time is ticking” when the persona was written in third person. For Peter, feeling “happy” was prioritised when the description was in third person and feeling “in control” when it was written in first person. For the mixed gender-neutral persona, no statistically significant differences were detected. For the complete record of differences between inflections using the Wilcox test, see Figure R.2 in the Appendix R.

		Correlations						
		PETER_T1	CLARA_T1	MIXED_T1_3RD	MIXED_T1_1ST	COMMON_T1_3RD	COMMON_T1_1ST	
Kendall's tau_b	PETER_T1	Correlation Coefficient	1.000	.929**	.786**	.714*	.714*	.857**
		Sig. (2-tailed)	.	.001	.006	.013	.013	.003
		N	8	8	8	8	8	8
	CLARA_T1	Correlation Coefficient	.929**	1.000	.714*	.786**	.786**	.929**
		Sig. (2-tailed)	.001	.	.013	.006	.006	.001
		N	8	8	8	8	8	8
	MIXED_T1_3RD	Correlation Coefficient	.786**	.714*	1.000	.786**	.500	.643*
		Sig. (2-tailed)	.006	.013	.	.006	.083	.026
		N	8	8	8	8	8	8
	MIXED_T1_1ST	Correlation Coefficient	.714*	.786**	.786**	1.000	.714*	.714*
		Sig. (2-tailed)	.013	.006	.006	.	.013	.013
		N	8	8	8	8	8	8
	COMMON_T1_3RD	Correlation Coefficient	.714*	.786**	.500	.714*	1.000	.857**
		Sig. (2-tailed)	.013	.006	.083	.013	.	.003
		N	8	8	8	8	8	8
	COMMON_T1_1ST	Correlation Coefficient	.857**	.929**	.643*	.714*	.857**	1.000
		Sig. (2-tailed)	.003	.001	.026	.013	.003	.
		N	8	8	8	8	8	8

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Figure 6.15: Comparison between gendered personas and gender-neutral personas written in 1st and 3rd person in Task 1 using Kendall’s tau correlation

Correlations

			PETERT2	CLARAT2	MIXED_T2_3RD	MIXED_T2_1ST	COMMON_T2_3RD	COMMON_T2_1ST
Kendall's tau_b	PETERT2	Correlation Coefficient	1.000	.818**	.818**	.758**	.818**	.848**
		Sig. (2-tailed)	.	.000	.000	.001	.000	.000
		N	12	12	12	12	12	12
	CLARAT2	Correlation Coefficient	.818**	1.000	.758**	.697**	.879**	.848**
		Sig. (2-tailed)	.000	.	.001	.002	.000	.000
		N	12	12	12	12	12	12
	MIXED_T2_3RD	Correlation Coefficient	.818**	.758**	1.000	.636**	.697**	.727**
		Sig. (2-tailed)	.000	.001	.	.004	.002	.001
		N	12	12	12	12	12	12
	MIXED_T2_1ST	Correlation Coefficient	.758**	.697**	.636**	1.000	.636**	.727**
		Sig. (2-tailed)	.001	.002	.004	.	.004	.001
		N	12	12	12	12	12	12
	COMMON_T2_3RD	Correlation Coefficient	.818**	.879**	.697**	.636**	1.000	.909**
		Sig. (2-tailed)	.000	.000	.002	.004	.	.000
		N	12	12	12	12	12	12
	COMMON_T2_1ST	Correlation Coefficient	.848**	.848**	.727**	.727**	.909**	1.000
		Sig. (2-tailed)	.000	.000	.001	.001	.000	.
		N	12	12	12	12	12	12

** . Correlation is significant at the 0.01 level (2-tailed).

Figure 6.16: Comparison between gendered personas and gender-neutral personas written in 1st and 3rd person in Task 2 using Kendall's tau correlation

Task 1: Gender-neutral personas' ranks for 1st person and 3rd person inflections											
Mixed - 3rd person			Mixed - 1st person			Common - 3rd person			Common - 1st person		
Feelings	M	μ	Feelings	M	μ	Feelings	M	μ	Feelings	M	μ
Safe	2	2.84	Respected	2	2.63	Comfortable	3	3.35	Respected	2	2.11
Respected	3	3.10	Safe	3	2.90	Respected	3	3.60	Safe	3	3.11
Comfortable	4	3.68	Comfortable	4	4.09	Safe	3	3.65	Comfortable	3	3.77
Confident	4	4.26	Appreciated	4.5	4.50	Confident	4.5	4.40	Appreciated	4.5	4.61
Appreciated	4	4.63	Happy	5	4.22	Happy	4.5	4.75	Happy	5	4.55
In control	5	4.68	In control	5	5.04	Appreciated	5	4.30	In control	5	5.27
Happy	6	5.68	Confident	6	5.04	In control	5	5.10	Confident	5.5	5.11
Engaged	8	7.10	Engaged	8	7.50	Engaged	8	6.85	Engaged	8	7.33

median (M) ≤3
 median (M) 4-5
 median (M) > 5

Figure 6.17: Ranks for gender-neutral personas written in 1st and 3rd person in Task 1.

Task 2: Gender-neutral personas' ranks for 1st person and 3rd person inflections											
Mixed - 3rd person			Mixed - 1st person			Common - 3rd person			Common - 1st person		
Features	M	μ	Features	M	μ	Features	M	μ	Features	M	μ
Relationship mode	5	4.52	Relationship mode	5	4.50	Common interests	5	4.60	Common interests	5	4.27
Common interests	5	4.47	Stay safe	5	4.50	Rate users	5	3.38	Stay safe	5	3.72
Stay safe	5	4.42	Common interests	5	4.36	Relationship mode	4	4.05	Join a group	4	4.05
Join a group	5	4.31	Rate users	4	4.18	Stay safe	4	3.85	Chemistry	4	4.00
Rate users	5	4.15	Chemistry	4	3.68	Join a group	4	3.84	Relationship mode	4	3.83
Chemistry	4	3.73	Join a group	4	3.63	Chemistry	4	3.84	Rate users	3.5	3.50
Self awareness	4	3.31	Self awareness	3	3.04	Self awareness	3	3.05	Self awareness	3.5	3.38
Time is ticking	3	2.94	Match boost	3	2.86	Match boost	3	2.85	Match boost	3	2.88
Smart move	3	2.84	Flirting tips	3	2.63	Smart move	3	2.85	Smart move	3	2.83
Match boost	3	2.73	Smart move	2.5	2.63	Flirting tips	2	2.55	Flirting tips	2	2.27
Flirting tips	2.5	2.88	Time is ticking	2	2.45	Time is ticking	2	2.05	Gift voucher	2	2.22
Gift voucher	2	2.22	Gift voucher	2	2.45	Gift voucher	1	1.85	Time is ticking	2	2.11

■ median (M) > 4
■ median (M) 3-4
■ median (M) < 3

Figure 6.18: Ranks for gender-neutral personas written in 1st and 3rd person in Task 2.

Task	Persona	Element	P-value	Inflection prioritised
Task 1	Clara	Comfortable	0.013*	3rd Person
Task 1	Clara	Happy	0.029*	1st Person
Task 1	Common	Appreciated	0.003**	1st Person
Task 1	Peter	Happy	0.037*	3rd Person
Task 1	Peter	In control	0.024*	1st Person
Task 2	Common	Time is Ticking	0.024*	3rd Person

Table 6.5: Differences in priority setting for each persona in task 1 and 2, according to personas' inflection. Statistical significance in the difference as a function of the perceived importance of each element, assessed using the Wilcoxon test is indicated with asterisks (* - $p < 0.05$; ** - $p < 0.01$; *** - $p < 0.001$).

6.4 Discussion

By analysing similarities using Kendall's tau correlation, it was possible to understand that the differences in the order of elements within the ranks produced by participants in the study for each persona are not significant, in general. By isolating the ranks produced by men and women for each persona, differences in the ordering of priorities are mostly not significant, with exception of ranks produced for the common neutral persona in task 1 (feelings). Differences in those two ranks are visible in the positions of "respected" (prioritised by women) and "in control" (prioritised by men). In task 2 (features), ranks for the common persona also reveal some considerable differences in the position of elements, but they are not statistically significant through Kendall's tau correlation. In those ranks "Chemistry" was considered a high priority in the rank produced by men but appears in the fifth position of the rank produced by women designing for the same persona. The "rate users" feature appears as a high priority in the rank produced by men, but appears in sixth position in the rank produced by women. "Match boost" appeared in seventh position in the rank produced by women and in the eleventh position in the rank produced by men. The differences between "chemistry" and "match boost" features are statistically significant when analysed through Wilcoxon test, which showed that men were more likely than women to prioritise the "Chemistry" feature while women were more likely to prioritise "Match boost", in

comparison to men. The differences that emerged in the ranks produced by men and women for the common gender-neutral persona indicate that they can understand users' needs in different ways and that the absence of gender can make more room for the influence of personal opinions. In order to understand these effects, it would be necessary to compare the use of two gendered personas with the use of a single gender-neutral persona in future research.

The Kendall's tau correlation test was useful for identifying that in task 1 the ranks produced for the mixed and common gender-neutral personas were more similar to the rank produced for Clara than for Peter, and that in task 2 the mixed persona was more similar to Clara and the common persona was equally similar to Clara and to Peter. Thus, with regard to rank ordering, in general, the gender-neutral personas presented elements' positions in a more similar fashion to Clara than to Peter. The Kendall's tau test together with the analysis of priorities through the categorisation of the data also revealed that gender-neutral personas inflected in first person were not likely to be perceived as a woman.

The analysis of the high priorities assigned for each persona through the categorisation of data (as of high, medium and low importance) was the main means of understanding whether gender-neutral personas return a rank of priorities that embrace both women's and men's needs. Results revealed that the common neutral persona encompasses both Clara and Peter's top priorities for task 1. The mixed neutral persona, in turn, encompasses the single Peter's priority for that task but only two of the three assigned to Clara. Moreover, despite the fact that the position of the elements in Peter's rank was more similar to the common gender-neutral persona than to the mixed one, it was possible to identify that the mixed gender-neutral persona encompasses both Clara's and Peter's top priorities for task 2. The common gender-neutral persona, in turn, encompasses the single Peter's top priority and only two of four Clara's top priorities in task 2. When analysing the two tasks together, it was also possible to detect that the mixed gender-neutral persona met six of Peter and Clara's top priorities while the common gender-neutral persona meet five of those priorities. Designing for Peter would lead to the exclusion of five Clara's priorities for tasks 1 and 2. Designing for Clara would ensure that both users' needs were met because Peter's priorities are also included in Clara's priorities. However, in this study, Peter engendered only two priorities while Clara generated seven priorities, among feelings and features. For this reason, it is not safe to conclude that this case applies to every other case and merging men's and women's needs would be ideal to ensure that both groups' needs are met. Thus, using a gender-neutral persona should return more inclusive design requirements since the focus is assigned to users' needs and designers would be less likely to empathise with one gender more than another. That is, considering the ideal scenario in which those priorities assigned by participants for each persona matched the real needs of users (men and women). However, it still remains unclear which persona would better serve for a gender-inclusive approach that takes into account women's and men's needs in a balanced way. So far, two concepts of neutrality were used in the creation of the personas, but a persona that merges both the needs in common and those exclusive of each gender should also be considered and tested in the future. In this study, both gender-neutral personas provided more inclusive priorities but the mixed gender-neutral one would meet more of both Peter's and Clara's priorities.

Some differences emerged by analysing the top priorities assigned by men and women for each of the four personas. In task 1, men produced ranks with more priorities than women when designing for Peter, women produced ranks with more priorities than men when designing for Clara and the common gender-neutral personas. No gender differences in the number of priorities were detected for the mixed gender-neutral persona. In task 2, women assigned more priorities to Peter, Clara and the mixed gender-neutral personas' ranks. Only for the common gender-neutral persona did men assign more priorities than women.

Considering that the rank produced for the common gender-neutral persona is very similar to the rank produced for Clara in task 1 and considering that women tended to assign more priorities than men to Clara and the common gender-neutral persona, and men to Peter, it is possible to infer that designers are more likely to agree with each other when designing for personas of their own gender, or perceived as such, with regard to the users' "feelings" (task 1). This effect can also indicate that designers are more likely to better understand the needs of personas of their own gender - the reason why the agreement between participants for important design elements is greater for those personas. In task 2, in turn, which is related to the application's features, such an effect cannot be perceived since women assign more priorities to Peter than men do. Recall from task 2 that the rank produced for the mixed gender-neutral persona was more similar to the rank produced for Clara than for Peter, and the rank produced for the common gender-neutral persona was equally similar to Peter's and Clara's ranks. Women tended to assign more priorities than men for the ranks in task 2 (14 priorities assigned by women, 10 assigned by men) but there were no differences in the sum of priorities in task 1 (9 priorities each). Thus, regarding features, it is possible that women perceive more of users' needs than men, in general, but more study is needed to investigate whether those perceived needs suit the reality of users' needs.

By using the Wilcoxon test to compare the values assigned to each feeling and feature in the four personas, it was possible to identify that the "relationship mode" feature was more likely to be prioritised for Clara when Peter and Clara were compared and when the common neutral persona and woman (Clara) were compared. The relationship mode feature was also more likely to be prioritised for the mixed neutral persona when Peter was compared to the mixed persona and when the common and mixed personas were compared. Feeling "respected" was more likely to be prioritised in the case of the mixed neutral persona compared to the common persona and to the man (Peter). The "stay safe" feature was also prioritised for a mixed persona when compared to the common persona and to the man. Analysing the distributions for the "respected" feeling, and for the "relationship mode" and "stay safe" features (see Figure Q.1 in Appendix Q), it becomes clearer that the common persona is more similar to Peter and that the mixed persona better represents Clara's qualities. Those statistically significant differences reveal that priorities derived from problematic issues in the user experience of dating apps would be much more likely to be addressed in design by using the mixed persona than by using the common persona.

In the analysis of high priorities in the ranks produced by men and women participating in the study, it became visible that both men and women were likely to assign a high priority to feeling "safe" for every persona, but men were more likely than women to prioritise feeling "happy" and "comfortable" when deciding for Peter, while women were more likely than men to prioritise feeling "respected" and "comfortable" when designing for

Clara. Women were also much more likely to prioritise the feeling of “respect” for the common persona than men.

The results of the Wilcoxon test confirm a statistically significant difference in the choice of feeling “happy” for Peter and the feeling of “respect” for the common persona as described above (see Table 6.4). Moreover, some other differences came to light. Women participants were more likely than men to prioritise the “stay safe” and “time is ticking” features for Clara and the “match boost” feature when designing for the common neutral persona. Men, in turn, were more likely than women to prioritise feeling “appreciated” and “in control” and the “chemistry” feature when designing for the common persona. It is possible that safety, respect, and the need to push interactions were more important for women while men can tend to give more value to feeling accepted, important and finding the right connections than women. These differences are also in accordance with the disclosure of gender bias in the design of mobile applications explored in Chapter 5: men and women were likely to disagree about the importance or lack of importance of some elements when assigning requirements to design projects.

With regard to person inflections in the descriptions of personas, there is no evidence that the first person inflection would imply more feminine qualities, either by comparing the ranks through Kendall’s tau correlation test or by comparing the priorities assigned to the two different inflections with the priorities assigned to the woman (Clara) and to the man (Peter).

It became clearer, however, that some feelings and features can appear more or less important in the ranks depending on the inflections. It seems that assigning values according to inflections leads to more differences with regard to feelings than to features, since five feelings presented statistically significant differences and only one feature did so. Moreover, differences, in general, did not tend to be prioritised according to one inflection or another. It is possible that participants engaged with each personas’ emotional needs differently when inflections changed, but they did not tend to prioritise features differently, with the exception of one feature (time is ticking) for the common persona. A deeper analysis of these effects would require carrying out a study focused on these writing styles, but so far, the results disclosed here indicate that the use of a different style of persona presentation would produce differences, especially with regard to the prioritisation of feelings.

In this study, so far, the use of gender-neutral personas led to design priorities that merge both the woman persona’s and the man persona’s priorities, but it remains to investigate whether the priorities assigned to those users match the reality and to explore the effects of the persona that merge both the needs in common between men and women and the needs that are unique to each gender. Moreover, with regard to person inflections, both the first and the third inflection appear to carry gender neutrality but the first person inflection would lead to more natural writing style while the third person inflection generate less natural descriptions for the pronouns are suppressed. It also remains to explore the effects of inflection on the empathy with users’ needs since the results of this study revealed more statistically significant differences in design elements between the two variants of inflection for “feelings” (task 1) than for “features” (task 2).

6.5 Contributions, challenges, and constraints

From a statistical point of view, the results disclosed here are constrained by the small sample size. More statistical differences could possibly emerge with a bigger sample. The idea of the gender-neutral persona emerged from the literature review on gender biases and gender differences in design. Previous work on the design of a methodology to investigate gender bias in design (see Chapter 5) brought the first insights to the neutral persona. A neutral persona was used on that occasion only to omit the variable of gender from the study, since the goal of the research was to detect gender bias in design. Some constraints may emerge in the use of this approach, which can be anticipated in this discussion. The use of a neutral persona may not avoid the unconscious assignation of a gender to the persona (that is most likely to be imagined as a man), but as said before, it would help to retain focus on the persona's needs rather than reinforcing stereotypes and gender scripts. Some projects would require a set containing more than one gender-neutral persona to encompass multiple important groups of stakeholders, although it is recommended to keep personas narrow and focused (Fleming & Koman, 1998), which is not always possible. In that case, one method would be to produce a gender neutral persona for each of the groups, if composed of women and men. Otherwise, there might be no need to use a neutral persona. Another scenario in which the gendered approach would probably remain the best option is when the project targets a specific gender. For example, an application to track ovulation and menstruation probably benefits more from emphasising sex, even with the attending stereotypes and gender scripts. However, the benefits of using neutral personas in gendered scenarios can be explored in future research. Future discussion of the approach to gender neutrality and technique proposed here can help to improve design tools and the design process as a whole since gender comes to light as a very important factor to take into account in mobile application development and other areas of design that can benefit from a neutral perspective.

The use of gender-neutral personas in this study showed that, depending on the task assigned to participants, one gender-neutral persona can be more gender inclusive than the other. However, for each task, at least one gender-neutral persona was capable of encompassing both women's and men's top priorities for that task. This study is limited to two approaches for creating gender-neutral personas, one that merges traits and needs in common between women and men and another that merges needs exclusive to each gender. A strategy to deal with conflicting priorities between genders would be required, since the needs of one group will eventually oppose the other. It remains to explore the effects of using a gender-neutral persona that merges both what is in common with and exclusive to both genders, which would probably motivate more inclusiveness by combining all needs into a single persona. However, the idea of this first study on gender-neutral personas was exactly to explore these two approaches separately in order to understand how they may lead to differences in the decision making process.

Furthermore, this study provides only a small overview of the implications of different writing styles in the description of personas. It seems useful, however, to know that such effects exist and result in elements of the user experience being more or less prioritised. More explorations with regard to the effect of person inflections

in the description of personas would bring about a more comprehensive explanation of such effects and possibly guidance for the textual presentation of users.

6.6 Conclusion

This exploration of the effects of the use of gender-neutral personas in the design of mobile applications revealed that these personas can comprise traits and needs important to both women and men users. They offer an alternative method for designing without gender labels. It became clearer through this study that assigning priorities in design is a matter of gender, as revealed in the previous study on gender bias in design (described in Chapter 5). However, this work also suggests options to counteract the effect of gender by focusing on users' needs rather than users' gender.

It became clear that women encountered more problematic issues in their experience of ODS, and, as a result, engendered more priorities in both tasks of the study. The results of this study revealed that a gender-neutral persona can lead to both women and men users' needs being prioritised in the decision making process of determining project requirements. Considering that women's needs and perspectives are very likely to be neglected, as explored in the literature review (see Chapter 2) and demonstrated in the previous studies of this thesis (see Chapters 4 and 5), the use of a gender-neutral persona seems to provide less room for men's needs to be overemphasised in relation to women's needs and, thus, to provide a more inclusive solution for defining design requirements.

This study was limited to two approaches to gender-neutral personas; referring to the inclusion of needs common to both men and women, or of needs exclusive to each in a combined description of the user. It remains to explore in future studies the effect of a gender-neutral persona that merges both needs common to the two genders and needs exclusive to each group. Additionally, an in-depth investigation of the effects of language, including the comparison of person inflections, in the description of a gender-neutral persona seems crucial to providing a better understanding of gender neutrality in writing, and accordingly, the creation of gender-neutral personas.

Chapter 7

Integrated discussion

In the last chapters, detailed information was provided about the literature underpinning this PhD research, the methods used in each investigation, and the studies conducted. The discussion of each study focused on the findings related to that exploration alone. This chapter provides an integrated discussion connecting the literature review, the research methods, the study of the experience of Tinder, the study of gender bias, and the explorations of gender-neutral personas. This discussion focuses on the main findings, on linking results to the questions posed, and on the research flow through the studies.

Mobile application development is a field of knowledge in which design and HCI concepts are merged to provide users with the best experience of technology. Within this hybrid area, interaction design emerged to provide the development of interactive systems with theoretical and practical support. Interaction design provides an overview of the design process and the steps to developing design solutions grounded in user research. It is a discipline strongly influenced by a user-centric approach, which explains the use of specific tools such as personas, scenarios and user journeys. Technological development, however, is assumed to be gender biased, for women are not well represented in design teams and in user research (Fountain, 2000; Wajcman, 2000; Ashcraft et al., 2016), designers are likely to embed developments with their own opinions (Bath, 2014; Oudshoorn et al., 2004; Akrich, 1995; Massanari, 2010; Mulder & Yaar, 2006; Pruitt & Adlin, 2006; Fleming & Koman, 1998), women have low levels of influence in team discussions (Rommes, 2014; Karpowitz et al., 2012; Williams, 2014), and due to a speculated unconscious tendency to consider men as the typical users of technological artefacts (Friedman, 1996; Bradley et al., 2015).

There are several mechanisms considered to lead to gendered artefacts (Bath, 2014), among which two are connected to problematic definitions of users: the “I-methodology” (Akrich, 1995) and the inscriptions of gender stereotypes (Oudshoorn et al., 2004). These issues are caused by a lack of user research (Rommes, 2014), and bias in development (Friedman & Nissenbaum, 1996). With regard to bias in development, there have been some attempts to identify gender differences in the production of print (Moss & Colman, 2001) and web designs (Moss et al., 2006), but designers participating in these studies were not asked to design for the same user or to design the same product. Thus, a question as to whether there are gender effects in designs produced by women

and men designers when designing for the same user and developing the same service was left open – to be answered by this PhD research.

It seemed crucial to investigate whether there are gender biases in design before moving on to a discussion of gender sensitivity that would provide approaches to enhance gender-awareness and tools to promote gender-inclusiveness in the design process. This PhD research, thus, focused on answering the question of gender bias, with the hope that this would help understand whether gender issues in women's experience are related to design, and how to counteract those issues in future research. To focus the investigation, it was decided that online dating applications would serve as the case study for this research project, and all the studies were therefore designed to investigate participants' perceptions of or decisions around dating services.

In order to design a method to investigate bias in mobile app design, it was necessary to understand whether the men's and women's experience of dating apps differed. This exploration would indicate whether there were gender issues indicative of bias in the experience of ODS that would justify the expansion of the investigation to the design process. In the first study, an initial investigation of women users revealed an overall sense of dissatisfaction with the Tinder service. Many issues caused by gender dynamics came to light, such as the impression of superficiality of a system deemed too sexual, the substantial experience of offensive behaviour, the feeling of not being fully respected by the majority, most women's perception that the app was developed by men, and the perception that men more often look for sex and women more often for relationships.

An empirical analysis of the graphical user interface exposed elements that could contribute to the experience reported by women: an oversimplified form of interaction and a dynamic of "picking and discarding" people that afforded the objectification of people, sexual harassment and the superficiality of connections. In this first batch of interviews with women alone, 57% uninstalled the application due to an overall negative experience of Tinder and 36% had concerns before installing it, mostly because they would feel ashamed if recognised by known people. Scholars researching hookup culture have found that men are much more likely to lose respect for women who hookup than for men (Allison & Risman, 2013; Bogle, 2008), that women have their pleasure neglected during such encounters since gender is a factor for meriting orgasm in casual sex (Allison & Risman, 2013; Armstrong et al., 2012), and that those who benefit from hookups are mostly men (Wade, 2017a). That double-standard regarding the loss of respect for women and men is probably caused by taboos around female sexuality and social gender roles, which are most likely the reasons why women users were afraid to be recognised by known people while using the application. Women were less likely to report to be looking for sex (7%) than for friendships (60%) and relationships (40%), possibly because engaging in such casual sexual encounters would not bring them pleasure, as highlighted by scholars. They would prefer to focus on relationships (Bradshaw et al., 2010) and friendships rather than hookups.

The experience of offensive gender dynamics by the majority of women participating in the phase 1 of the first study is probably a consequence of sexism and misogyny ingrained in social relations that is worsened in virtual environments, since people feel more free to expose their beliefs under the anonymity of the Internet (Wajcman, 2004). The experiences reported by women indicated that the application was possibly designed to attend to men's interests, and thus, biased in its development. However, this assumption had to be investigated

by understanding whether men's and women's interests would differ, and whether men would benefit more from the use of the app than women. It was also considered possible that men would feel exactly the same way, indicating that women's frustrating experiences and the harmful gender dynamic was not caused by bias in design or facilitated by the app.

The second phase of recruitment was carried out two years after the first and involved both men and women users of Tinder. It revealed that both groups were looking to meet new people and make friends as a priority and for partners for a relationship second. No women reported looking for sex while 17% of men did so. Men were twice as likely to look for hookups than women (48% of men against 24% of women), but that difference only approaches statistical significance. There was a relevant increase in the numbers of women who reported looking for hookups, since only 7% indicated so in the first group of women users, and they specifically pointed to sex as a motivation rather than "casual encounters", as highlighted by the women in the second group. It is possible that women are therefore feeling increasingly empowered regarding casual sexual encounters over time. This difference in hookups between women in the two phases, however, is not statistically significant.

The comparison of women users of Tinder in phase 1 and phase 2 of the first study revealed that their experience was very similar, despite the two years' gap in between. They had the same primary motivations for use, the same impressions, reported the same benefits and downsides, and the majority of the two groups ended up uninstalling the app after an overall frustrating experience. The statistically significant differences pertain to the women in phase 2 being less likely than those in phase 1 to report offensive behaviour and being more likely to feel "often" respected. These two facts indicate that either interaction evolved to embrace a more respectful gender dynamic or women got used to the gender dynamic reported by women in phase 1. Since the percentage of offensive behaviours reported and the percentage of women who felt the app was "too sexual" did not change much, it is possible that women are less likely to feel harassed by a direct sexual approach than women were in phase 1. Trends were also detected in terms of women being more likely to report hookups as a motivation to use Tinder, as already mentioned, and being less likely to point to friendships and relationships as benefits of use.

Both men and women expressed concerns about installing the app (32% of women and 24% of men). Women highlighted many of the same reasons expressed during the first interviews with women users alone; a fear of being recognised and feeling ashamed, but also of being judged, feeling vulnerable, and being objectified. Men, in turn, mostly expressed that they were sceptical about using an app to fulfil their needs. The fact that women will lose respect in their community if they hookup came to light again, but also that they were concerned about their physical and emotional integrity. The fact that no woman reported to be looking for sex reinforces the assumptions posed in the discussion of the first phase of interviews that either there exists a taboo around female sexuality that made them feel ashamed of hooking up and, consequently, to repress their urges, or that they were less likely to be looking for casual sex because they felt they would not find pleasure in that kind of encounter (Allison & Risman, 2013; Armstrong et al., 2012), because they would be vulnerable to sexual assault and rape (Hamilton & Armstrong, 2009; Flack Jr et al., 2007; Wade, 2017a), or for both reasons.

A relevant difference emerged with regard to the benefits of using Tinder. Men were much more likely to report easily setting up dates as a benefit: 35% of men pointed to this factor while no woman did so. Meeting

new people (and making friends) was the benefit most frequently expressed by both men and women. Finding a partner for a relationship was the second most frequently recounted benefit for women and the third for men, after “easy dates”. This reinforces the fact that hooking up was not considered a benefit for women, although some reported it as motivation. It is possible that the lack of pleasure found in brief encounters or the emotional conflict due to social shame, as suggested by the authors above, underlie women’s reasons not to report hookups as a benefit. No women reported any sort of sexual assault or rape in both studies, which could be excluded as a reason for not benefiting from casual encounters. It is also possible that women in the study did not feel comfortable saying that they benefited from hookups due to the power of the taboo concerning reporting sex or casual dates as a benefit. More in-depth interviews could elicit answers to these possibilities; however, this study was limited to the purpose of quantifying participants’ experience in order to compare men’s and women’s experiences of ODS.

Statistically significant differences emerged with regard to the downsides of the application as well. Women were more likely to experience offensive behaviour and to find it too sexual. The first group of women gave more details as to how they found a direct sexual approach offensive but a quarter of women in the second phase only noted that it was “too sexual” and it was not possible to infer that they felt harassed or offended. Comparing reports of offensive behaviour during the first and second phases, two years apart, shows a substantial drop in reports of such experiences as a negative side of the application. It is possible that this problematic gender dynamic has been mitigated over time through the app or that women were less likely to report sexual harassment. However, a closer look at the feeling of respect during the experience of Tinder reveals that women were less likely to feel completely respected over time, although they are also less likely to feel completely disrespected. All men reported feeling completely or often respected. A statistically significant difference emerged by comparing the feeling of respect between men and women: only 12% of women felt completely respected but 66% of men felt so.

The majority of women uninstalled Tinder because of an overall negative experience while the majority of men uninstalled it because they started a new relationship. Most participants in both groups believed the developer was a man. It is not clear whether this perception is because the app appealed more to men’s group or because mobile development is usually dominated by men. In either case, the influence of men’s participation was felt by the majority of women and men participating in the study. A closer look at the perception of gender differences in motivations to use Tinder by users revealed that the majority of women in the first and second phases believed that women and men had different motivations: men were more often looking for sex and women for relationships. Although these differences in motivation only approach statistical significance, men were two times more likely to look for hookups than women, and much more likely to benefit from the experience. The majority of men, however, perceived no difference.

Given that fact and that mobile development is dominated by men, indeed, the assumption that developers would tend to normalise gender by developing for the men’s norm becomes more salient. This claim is made and supported by those authors who observe that unconscious design decisions result in the satisfaction of the interests of designers (and developers), who happen to be mostly men (Oudshoorn et al., 2004). In this instance,

it became clear that the application met men's needs more than women's: men would use the app for longer, women would uninstall it mainly due to a frustrated experience, women were much less likely to feel respected, men benefited from hookups much more than women, and women were more likely to perceive a conflict of interest in terms of gender, among other findings.

Following these two studies it became clear that there are gender dynamics that differently affect the experience of women and men, which is very likely to be worsened by gender biases in development. In order to investigate whether there are gender differences in designs produced by men and women, a study composed of three design tasks was subsequently planned. The information provided by the men and women who participated in the first study on gender differences in the experience of Tinder was used to create these tasks as well as a gender-neutral persona. For example, potential design features such as "match boost" and "smart move" were based on men's data, while "stay safe", "rate users", and "relationship mode", were based on women's data. Certain other possible design features were based on improvements suggested by the users who responded to the initial interviews.

The creation of a gender-neutral persona was necessary to enable the exploration of biases in a more complete manner. Although explicitly describing genders could also serve as an appropriate approach to this research, some questions such as the inclination to consider the user a man and the usefulness of gender in persona description would remain unanswered. The outcome of employing a gender-neutral persona gave rise to the last study of this PhD (see Chapter 6), in which this initial exploration of the effects of using a gender-neutral persona in the design process was extended.

The study on gender bias described in Chapter 5 involved two groups of participants: students taking computer science courses and students taking design courses. Participants were asked to perform the tasks (see Appendix L) based on a method created for this study (Lopes & Vogel, 2019). Gender biases were explored through four tests: differences by participants' gender, by personas' perceived gender, by participants' gender for the persona perceived as a woman, and by participants' gender for the persona perceived as a man. Moreover, the same four tests were conducted with pooled data from the two groups as well.

The results of the study on gender bias disclosed the presence of gender bias within the two groups analysed: computer science students and design students. Participants in the computer science group guessed the gender of the neutral persona in a balanced way while participants in the design group were more likely to perceive the persona as a man. Participants in the design group were also asked about noticing the absence of gender and the large majority did not notice that there was no mention of gender in the description of the persona. The perception of the difficulty of avoiding influencing design with their personal opinions by the majority of computer science students and more than a third of design students supports the assumption that biases are likely to occur. By comparing the decisions made by the women and men participating it became clearer that design is very likely to be biased since many differences emerged with regard to the priority assigned to design elements. Gender biases were more statistically significant within the computer science group, in which differences were detected for 16 design elements, while in the design group differences were found for 10 design elements.

Furthermore, several of these elements presented a more expressive level of significance in the tests conducted with the computer science group.

This study also revealed biases connected to participants' background. By comparing the two groups, it was possible to find statistically significant differences that could interfere in the choices made for design requirements. However, since four design elements were prioritised by the design group and another four by the computer science group, and given that all differences express the same level of confidence, it is only possible to say that computer science and design participants design differently, regardless of gender. It was also possible to notice that design students were more committed to stimulating good behaviour through the app for they were more likely to prioritise empathy, politeness, respect, and honesty, while computer science students tended to prioritise an appealing personality (creative, intriguing) and the performance of the app (effectiveness, self-awareness).

Different strategies have been suggested by authors in order to counteract bias and gender issues in the design process, such as participatory design (Rommes, 2006), value sensitive design (Friedman, 1996), reflective design (Sengers et al., 2005), undoing design (Brigham & Introna, 2007) and de-gendering design (Bath, 2014). However, these strategies mostly provide guidelines to improve sensitivity and support reflection on gender issues during the design process. There is still a lack of practical tools to help minimise the inscription of gender stereotypes in user descriptions and to counteract the tendency to prioritise men's needs. This study on gender bias brought to light the concept of gender neutrality in the description of personas and scenarios, which laid the groundwork for this last investigation. The results indicated the feasibility of employing a gender-neutral persona and also that it could serve as a tool to retain a focus on users' needs rather than on gender. Since persona is a widespread tool for designing interactions and very often used in mobile app development, a study was proposed to explore the effects of gender-neutral personas on design requirements (see Chapter 6).

In this particular study (third study of the PhD), a set of personas was created, composed of a man and a woman, two gender-neutral personas, and variations of each with pronouns and verbs inflected in first person (see Subsection 6.2.7 in Chapter 5). Thus, a total of eight personas were created. One gender-neutral persona presented aspects of the experience of dating apps common to men and women (common gender-neutral persona) and the other gender-neutral persona presented aspects of the experience exclusive to each gender, merged into a single character (mixed gender-neutral persona). Findings from the first study of users' perceptions of Tinder (see Chapter 4) yielded elements characterising women's and men's experience of Tinder to support the creation of this set of personas.

Participants were asked to perform some of the tasks (see Appendix L) proposed in the study on gender biases (see Chapter 5), and the results for the set of personas compared. The idea was to understand whether the gender-neutral personas would lead to design choices that included both men's and women's priorities. In order to know what was considered women's or men's priority, it was necessary to rank the values assigned to each element of the tasks for each persona. The differences between the ranks were then explored through three tests: differences by participants' gender, by personas' gender, and by inflection.

Participants in that study assigned priority to feeling “safe” and to the “common interests” feature when designing for the persona that is a man. The persona that is a woman led to more priorities: feeling “safe”, “respected”, “comfortable”, and to support for the “relationship mode”, “stay safe”, “common interests”, and “rate users” features. The priorities set for the man were also set for the other personas and, consequently, designing for either the woman or the gender-neutral personas would also meet men’s requirements. The focus, then, was to identify whether the gender-neutral personas would include women’s priorities and which would be more inclusive.

For the task of sorting feelings by order of importance, the rank produced for the common gender-neutral persona was very similar to the rank produced for the persona that is woman and both ranks shared the same priorities. The rank produced for the mixed gender-neutral persona met only two of the woman’s priorities. For the task of sorting features, the common gender-neutral persona met two of the woman’s priorities while the mixed one met all four priorities. Thus, both gender-neutral personas lead to more inclusive requirements but the mixed gender-neutral persona lead to more inclusive priorities, at least for this study of dating apps. As a first exploration, this study revealed that merging gender into a single persona can meet different gender needs and at the same time remove the focus on gender to discourage the use of stereotypes, gender scripts, or over-emphasis of the needs of the persona that is a man. Further explorations would be necessary to understand designers’ interactions with a gender-neutral persona that merges both gender common and exclusive needs together, and to measure the possibility of counteracting gender stereotypes in the design process.

Personas have traditionally been written in third person, but in order to hide gender as part of a neutral approach, two different variants were created. One in which the pronouns are omitted but verbs inflected in third person and the other entailing pronouns and verbs in first person form. The omission of pronouns leads to a less natural writing style and the use of the first person form could be associated with women’s writings (Argamon et al., 2003). The comparison between descriptions written in third person and first person revealed no tendency to interpret the gender-neutral personas as womanly due to the inflection alone.

A closer look at the ranks produced by women and men participating in this study reveals that men and women were more likely to agree when taking decision for personas of their own gender. This is visible in the first task of the study (sorting feelings) in which elements only emerge as top priorities if the median values assigned to them are between 1 and 3.

The ranks of priorities produced for the woman, the men and the gender-neutral personas did not reveal statistically significant differences in the general ordering of elements, but by comparing the ranks produced by women and men participating in the study, differences emerge for the understanding of the common gender-neutral persona. Elements that are considered very important for women are not deemed so for men and vice-versa. This reveals that, despite the apparent benefits of using gender-neutral personas, this can also open space for personal interpretations of needs and gender in light of the absence of gender specifications.

As discussed in the literature review in Chapter 2 and earlier in this chapter, products and services are likely to be designed for the men’s norm (Bradley et al., 2015; Friedman & Nissenbaum, 1996; Oudshoorn et al., 2004), and, for this reason, it is important to understand that gender-neutral personas can also make room for

personal bias to occur even though developed to counteract it. As pointed out by Rommes et al. (1999) in the case of the “digital city of Amsterdam”, some users’ needs were disregarded in the project and personal bias prevailed in the assignment of requirements and priorities. In the case of this study, the presence of both men designers and women designers produced more balanced requirements, which merged both women’s and men’s priorities. This indicates that a balance of gender within design teams may also play an important role in how personas are interpreted. Thus, on the one hand the inclusion of women in design teams is considered not sufficient to promote gender inclusivity in products and services (Fountain, 2000; Wajcman, 2000; Ashcraft et al., 2016), but on the other hand their presence appears to be decisive for embedding the design process with a balanced perspective. That is, if personal bias is unavoidable, then gender representation in design teams is imperative. It is possibly a combination of gender representation and gender-inclusive design tools that will improve the user experience for woman. In future studies, it would be useful to compare decisions taken between participants who were presented with the two gendered personas and participants who were presented with the single gender-neutral personas. The question would be whether designers and developers would establish more inclusive requirements by using a gender-neutral persona or by using two (or more) clear gendered personas.

This PhD research revealed that women and men had different perceptions as users of online dating services (ODS), different needs while using dating applications, that design decisions were influenced by participants’ gender, that the gender of the persona used in the design process led to different design decisions, and that it was possible to address more inclusive design priorities by designing for a single gender-neutral persona that merges both women’s and men’s needs into a single character.

The central research question of this PhD research aimed to answer whether gender affects the design of mobile applications and the user experience, which unfolded into four questions, which are restated here followed by the answer to each:

1. Are there gender differences in the experience of dating applications? Yes.
2. Is designed influenced by designers’ gender? Yes.
3. Is there a tendency to consider the user as a man? Not among computer science students but there is a tendency among design students.
4. Do gender-neutral tools lead to design priorities that meet both women’s and man’s needs? Yes.

In this integrated discussion, a focus was given to elucidating how the research flowed from one study to the other by answering questions and posing new questions that were left open at each point in the process. For this reason, only the main results were recounted here, those that were important to understanding the research flow and that helped to answer each research question. This chapter is restricted to the discussion of findings in relation to theories and concepts cited in the literature review. An elaboration on the impact of the work, on the problems revealed by the studies conducted in this research, and an expanded discussion of future work is provided in the next chapter (see Conclusion, Chapter 8).

Chapter 8

Conclusion

This PhD research was focused on identifying whether there are gender effects in mobile application development, more precisely in online dating apps, which served as the case study for this investigation. The research method encompassed three studies involving semi-structured interviews, surveys, and design sessions (see Chapter 3). Design tools were used to assess participants' perceptions, and results were analysed with statistical tests (Wilcoxon/Mann-Whitney, Chi-squared test, Kendall's tau correlation, and binomial test). The findings of the studies were explained in detail in each chapter dedicated to them and summarised in the integrated discussion (see Chapter 7).

The research flow between research questions and the results of the studies of this thesis are summarised in the previous Chapter (see Chapter 7). In this concluding chapter, an overview of this work is resumed, however a focus is given to the ideas for future explorations. Since the previous chapters focused on the studies that were carried out for this research and the ideas for future studies go beyond the studies proposed in this thesis, it seemed appropriate to leave a more expansive discussion for the conclusion. This last chapter is structured in two sections, one about the gender effects revealed throughout the thesis and another focused on future explorations based on the results brought to light here.

8.1 Gender effects in design

Online dating emerged initially as a service to facilitate relationship formation, however the increase in use in the last several years has possibly been driven by the flourishing of hookup culture and the advance of mobile technology. Dating apps are very popular among young people, who are comfortable experimenting with new technologies and are heavy users of mobile phones. Online dating applications provide many benefits enabled by the Internet such as privacy, anonymity, the relative safety of virtual environments, speed of access to meeting people, and simultaneous engagement with many users. Because dating apps are becoming so well accepted, they shape sexual behaviour through technology, embedding new social values that emerge in the dating realm. It is hard to say what influences what, but most likely casual sexual experience and technology simultaneously

influence each other. On one hand, technology facilitates dating and the spread of hookup culture, and on the other hand technology is adapted in order to attend to the demand for casual interactions.

Data collected from women users in the realm of online dating has shown that a great number of women felt frustrated and disrespected after their experience on Tinder and reported a high rate of offensive behaviour towards them (Lopes & Vogel, 2017). That fact suggests the need to reflect on gender differences and on concerns that emerge from the anonymity supplied by the Internet. While on the one hand, cyberspace can be considered a place to engage and deepen intimacy with minimal risks (Wajcman, 2004; K. Y. McKenna et al., 2002), on the other hand, offensive behaviour towards women can be intensified (Massanari, 2017; Lin, 2017; Shepherd et al., 2015). The experience of offensive behaviour by women is marked by sexist remarks and impolite sexual approaches that compromise the experience and leads to an overall frustrating experience for women. This resulting experience indicates a gendered structure of power rooted in man-woman relationships that still pervades technology and affects sexual interaction dynamics, whether romantic or not.

The experiences of women on Tinder are very likely to be caused by gender bias in the development process, which tends to prioritise men's needs over women's. The study of gender bias recounted in this thesis revealed that there were statistically significant differences in priorities assigned by men and women in the design process. Hence, men's domination in technology also poses obstacles to gender inclusiveness in the use and adoption of dating services if the expectations and needs of women are not met. Hence, there are two major social concerns that emerge from this reflection on online dating applications and their consequences for gender relations: the disregard of women's needs and the support of sexist behaviour.

Approaches such as user-centred design and participatory design put the user at the centre of design projects and should help to mitigate gender bias in design. Personas, for example, are used in the early stages of the design process to help the development team to engage and empathise with users (Marsden & Haag, 2016; Pruitt & Adlin, 2006; Nielsen et al., 2015), in order to understand their needs and expectations (Cooper, 1999). The use of personas encourages designers to avoid designing for their own needs or for the stereotyped ideas they have of users. This tool also facilitates communication between team members and with stakeholders, who can refer to a "person" when taking decisions instead of using the generic term "users". However, Williams (2014) draws attention to barriers in user centred design (UCD) and explains that even when tools are used to reduce bias, there are still many design decisions influenced by personal opinions of the members of design teams that affect the development of products (Oudshoorn et al., 2004). Indeed, the majority of participants in the study on gender bias recounted in this thesis disclosed that they found it medium difficult or difficult to take decisions for the persona provided without taking into account their personal opinions. Those issues pointed to by the authors referenced above, which are related to gender bias in design, are explored in this PhD thesis through four studies that attempted to understand gender differences in users' perceptions, in the design process, and in the interpretation of personas.

If designers and developers tend to base some decisions on their personal opinions, the usual male composition of design teams may obstruct the inclusion of women's perspective in design. The underrepresentation of women in technology and science (Bruce & Lewis, 1990; Buckley, 1986; Cockburn, 1981; Fountain, 2000;

Henwood, 1993; Keller, 1985; Wajcman, 2007) is most likely the reason why the ideation and development of solutions to mobile phones are biased from the beginning of the design process. A unilateral men's reasoning may guide important design stages in which problems, opportunities, motivations and approaches are defined. Considering that the sexist mindset is ingrained in social behaviour, it is also likely to pervade every product and service designed by men. Even if men designers attempt to imagine the needs of women, they may misperceive the nature of those needs in the absence of balanced input from women colleagues and women users. Without a balanced womanly presence in the mobile device industry no equality can be guaranteed, and, women's needs and expectations are very likely to be neglected. Thus, as a consequence, technological developments are mainly designed by men and the solutions probably address a men's perspective on the matter. The perception of the masculinity ingrained in mobile applications is connected with women's frustration in dating applications. The study with women users of Tinder revealed that 85.3% of participants surveyed believed that the application was developed by a man. The inclusion of women in the development process (as users in a user centred approach, as designers, or as developers) may reduce gender bias within technological products since women's needs and visions can be taken into account. For example, in the website realm, a study carried out by Moss and Colman (2001) showed that users are more likely to prefer the design produced by a person of their own sex; that is, women prefer women designers, and men, men designers. Without a balanced representation of gender in user research and gender mixed teams it is difficult to include women's point of view in design. However, Keller (1985, p.175) argues that the inclusion of women or their vision is not enough to support a gender-free science; a step towards transformation "would be the undermining of the commitment of scientists to the masculinity that would be an inevitable concomitant of the participation of large numbers of women."

Reflection on this topic brought a question to light: how would the interaction feel if women's needs were met and the graphical user interface designed to address changes? Even if the graphical user interface was gender neutral, would it be possible to stimulate a more respectful communication between women and men, only through the design of the interaction? Taking as an example the study with users of Tinder, in which few women reported to feel respected and participants pointed out sexual harassment as the worst part of the experience, how could women feel confident and respected and how should the interface control the expression of sexist behaviour? In order to incorporate these changes in design, features that enhance cooperation, empathy and respect should be embedded in the application. So far, this research focused on understanding whether gender bias occurs in development and the effect of using gender-neutral personas as a tool to encourage more gender-inclusive design requirements. The study on gender bias revealed differences in how men and women take decisions and prioritise design elements in the design process. These results led to the consecutive exploration of the use of gender neutrality in the description of personas. The use of gender-neutral personas led to inclusive priorities in the setting of requirements for a dating app, but the effect on the interaction design and on the graphical user interface (GUI) might be tested in future studies.

8.2 Areas for future research

Some ideas for further exploration were mentioned throughout the work and are resumed here. Furthermore, more reflection and ideas are brought forward in this concluding chapter.

In the second study, it was demonstrated that the neutral persona proved to be a feasible approach to design for many participants in the study did not notice the absence of gender in the user description. However, the gender-neutral persona created for that study had no gender traits and did not represent the user needs of different groups. It remains to explore the construction of personas based on real user needs of different groups merged in a single user description. Moreover, the correlation between gender effects observed and the expression of masculinities and femininities in specific groups is left unanswered. This is a topic to be explored in order to better understand gender bias in the design process.

In the third study, differences that emerged in the ranks produced by men and women for the common gender-neutral persona indicate that people can understand users' needs in different ways and that the absence of gender can make more room for the influence of personal opinions. In order to understand these effects, it would be interesting to compare the use of two gendered personas with the use of a single gender-neutral persona in future research. Furthermore, that study used two gender-neutral personas which had either elements in common between men and women or elements that are exclusive of each gender mixed in one single persona. The ideal scenario for a real use case is that all important needs are mixed in a single gender-neutral persona to achieve the goal of meeting both users' needs. In the case that more gender groups are involved, it would also be important to explore the effect of mixing more groups' traits in one persona.

With regard to online dating practices, it became clear that the user experience is marked by gender dynamics that are not beneficial for women, in general. Some ideas emerged from reflexion on the results and feedback from participants. Some ideas emerged from reflexion on the results, feedbacks from participants, and solutions that are available on the market of digital services that are described below.

Bumble is an app that address some of the concerns related to gendered power relations reproduced through online dating services. Despite using essentially the same GUI as Tinder, in which superficiality is apparently encourage by a "pick and discard" interaction, initial contact can be only made by women. On the one hand, this concept can give women the initiator advantage that is typically granted to men (Kreager et al., 2014), challenging one of the gender norms implicit in dating apps. On the other hand, this approach misses the chance to encourage respectful communication on the basis of equality. This service implies that in order to empower women it is necessary to grant them different rights through the application. In addition to this innovation, Bumble offers more filters, an improvement that was requested by users interviewed in this research.

Other services, beyond the realm of dating apps, could possibly provide solutions for the design of ODS. A service such as AirBnB, for example, is a good example of how it is possible to stimulate respect through the design of communication. Airbnb is a service supported by a "shared economy" which is a new modality of peer-to-peer sharing of services and goods. Shared economy empowers users to share through information and communication technologies (Quattrone, Proserpio, Quercia, Capra, & Musolesi, 2016) and leverages

“collaborative consumption” as an attitude towards the adoption of sustainable practices by conscious users (Hamari, Sjöklint, & Ukkonen, 2016). The use of the AirBnB service brings risks for both hosts and guests that are intrinsically related to trustworthiness (Ma, Hancock, Mingjie, & Naaman, 2017), in a similar fashion to the use of Tinder. In dating apps, most users are very concerned about deceptive profiles (Ellison, Hancock, & Toma, 2012) and feel uncertainty regarding the honesty of self-disclosure (Gibbs, Ellison, & Lai, 2011). It is exactly for their success in developing strategies to reduce uncertainty that Airbnb is so popular worldwide. When renting a home through the Airbnb site, both host and guest depend on each other’s feedback in order to keep using the service. Users are controlled by the service in different ways: they have to provide personal information such as a picture, identity card, a verified mobile number, and so on, but their trustworthiness is also controlled by other users. For that purpose, they both rate each other after using the service, and get rewarded for outstanding performances. Rewards are the key to stimulating good behaviour while using the service. Behaviour also includes the usage of the rented home, not only the communication online. Users can get rewards from other users, which are positive reviews or feedbacks that will help them in future rentals, and can get rewards from the system, which can be a voucher to spend on Airbnb accommodation or a “super host” status upgrade, for example. Apart from getting rewards, users have the chance to assess their performance and gain self-awareness. If one treats guests well or their house well, one will probably get a good review, if one mistreats them, one will miss the chance to obtain a recommendation or will receive a negative review. It is unlikely that a user that is disrespectful on Airbnb will not be punished. The same does not occur on Tinder, there are virtually no consequence for bad behaviour. While the design of the interaction on Airbnb does not tackle gender issues directly, it tackles misbehaviour through features that enhance mutual trust and respect. Thus, these kind of features can serve as a reference for improvements in virtual communication, regardless of the purposes of the services.

Possibly, if women and their concerns were taken into consideration from the beginning of the project of an online dating application, features that give them control within the communication process would stimulate a change from gender hierarchy towards a more balanced and respectful form of interaction. If women felt respected, they would be more likely to keep using the application. Men would be more likely to sustain communication with women if they could learn how to behave in order to be rewarded by users and by the system. Such a rating system may seem disturbing at a first glance, however, if it exists as a non-public feature, that is, if the rates are running in the background of the system and are used to generate reports (so that users can understand what they are doing wrong or well) and to count accumulated points in order to obtain rewards, then ratings can be approached in a positive way.

If it is the case that men want to have more easy dates and women need to feel respected, it is possible that both would get what they want if some effort was made to design an interface that encourages a change of behaviour. Women would feel more confident to engage in online interactions and feel more comfortable to meet people and express their desires if they felt respected. As a consequence men would also enhance their chances to have what they want. Hence, both men and women benefit from respectful interactions that should be incited in online dating services in order to meet both men’s and women’s needs.

Apart from incorporating features that encourage respectful behaviour in online dating environment, the development of methods to evaluate applications and to design new interfaces that explicitly address gender as a factor and highlight a critical form of "gender thinking" is also crucial in order to design for gender inclusiveness. Approaching gender neutrality in design tools can mitigate the proclivity to engage and empathise more often with personas that are men and, accordingly, to designing for the men's norm. For that reason, the construction of a gender-neutral persona was explored in this research. A gender-neutral persona that merges both women's and men's needs proved to be feasible and useful as a means of including users' needs in a balanced way.

In order to move forward and improve the "gender thinking" of the interaction design process, it is necessary to develop a deeper study of the gender factors in design and the development of gender-neutral persona techniques to be integrated into the design process. There are factors to be explored in order to improve the creation of gender-neutral personas. First, the concept of "neutrality" can be approached in two different ways; a user and a service description can be neutral in a way that merges both men and women (and, possibly, transgender) users' traits or in a way that only needs in common with all gender groups are included in the descriptions (only non-stereotyped traits that suit both users). Despite the fact that participants recruited to this project fell into a man-woman polarity, this technique can attend to a wider spectrum of genders since it would not be marked with gender traits, needs or perspectives. The idea behind the creation of a gender-neutral technique is to improve gender inclusiveness in a broad sense. The idea is that users' needs can be considered without a gender label.

The discussion initiated in this research is a first attempt to bring awareness to the impact of gender in the design of online dating applications. The arguments presented throughout this document were useful to understanding gender issues in online dating apps but they are even more useful to explaining a design problem rather than a dating problem alone. Design is a whole field embedded with gender biases, whose consequences can be detected in different products. Van Oost (2003), for instance, explored how gender stereotypes are translated into design requirements in the development of shavers for women. This research is limited by the methods, the sample and the cultural context of participants, by the tools used and the stage of the design process investigated. It is possible that explorations in different stages of the design process and with different tools would disclose new angles on gender biases and new ideas to promote the inclusion of women's needs in design projects.

A next step towards the development of gender-inclusive interactions and products is to raise awareness of gender in the development of products and its impact on users' wellbeing, and to provide practical tools that mitigate gender biases in the design process. The disregard of gender issues in design can undermine the promotion of gender equality in technology. For this reason, it is important to emphasise that there are invisible layers of gender inequality that go beyond the underrepresentation of women in technology. One of those layers concerns the consequences of human behaviour for human-human communication caused or stimulated by misconceived gendered ideas deeply rooted in society and reinforced through technological developments. It is crucial to explore the implications of gender in design in order to bridge the gender gap in the development of

technology. Gender is hidden in developments and appears mostly as an implicit factor in design. Thus, it must be brought to light in order to promote advances in the field with regard to gender equity.

Appendix A

Study 1 - Interview questions: translation to portuguese

Question 1 - Por que você instalou o aplicativo? O que você buscava e quais eram suas expectativas?

Question 2 - Você precisou pensar antes de instalar o Tinder? Por que?

Question 3 - Qual foi sua primeira impressão quando começou a usar o app?

Question 4 - Como você se sentiu com relação aos primeiros matches?

Question 5 - Como se sentiu com relação a abordagem do app e a interação baseada em matches?

Question 6 - Quais foram os aspectos positivos da sua experiência? Conte-me sobre algumas situações.

Question 7 - Quais são os aspectos negativos da sua experiência? Alguma coisa desagradável aconteceu? Conte-me sobre essas situações.

Question 8 - Você se sentiu respeitada na sua experiência do Tinder?

Question 9 - Por quanto tempo você usou o aplicativo?

Question 10 - Você desinstalou?

Question 11 - Se desinstalou, qual foi o motivo?

Question 12 - Você acha que uma mulher ou um homem desenvolveu o app?

Question 13 - Você vê alguma diferença no que as mulheres e homens buscam no Tinder? O que eles buscam, em geral?

Question 14 - Você tem amigos que usaram/usam o app? Qual a opinião deles, em geral?

Question 15 - Como sua experiência no Tinder poderia ter sido melhor?

Question 16 - Você usou outros aplicativos de relacionamento? Qual você preferiu?

Appendix B

Study 1: List of words - PHASE 1

Q1	Q2	Q3	Q4	Q5
Curiosity	No	Easy	Confident	Assertive
Friends	Yes	Exciting	Neutral	Empowering
Language		Fun		Innovative
Other		Invasive		Neutral
People		Sexualised		Privacy
Relationship		Superficial		Reciprocity
Sex		Unfiltered		Superficiality
		Unsafe		
Q6	Q7	Q8	Q9	Q10
Empowering	Addictive	Always	less than 1	Yes
Friends	Low interaction	Never	less than 6	No
Fun	No	Often	less than 12	
Information	No filter	Rarely	less than 24	
Language	Offense	Sometimes	less than 36	
No	Other			
People	Racism			
Relationship	Repression			
Self-esteem	Sexism			
	Sexual			
	Superficial			
Q11	Q12	Q13	Q15	Q16
Frustration	Both	No	Better users	Badoo
No interest	Man	Yes	Chat improvement	Tinder
Relationship	Woman		Choose name/pics	Happn
Repression			Find boyfriend	Kick Off
			Go back in choices	Lovoo
			Less expectation	No
			Less hesitation	Once
			Less superficial	OK Cupid
			Limit time/likes	POF
			Nothing	Yahoo
			More filters	
			More interaction	
			More patience	

Table B.1: List of the resulting words of the categorisation of answers in phase 1.

Appendix C

Study 1: List of words - PHASE 2

Q1	Q2	Q3	Q4	Q5
Casual	No	Addictive	Confident	Confusing
Curiosity	Yes	Awkward	Curious	Easy
Pastime		Disappointing	Indifferent	Effective
People		Exciting	Not reciprocate	Fun
Friends		Fun	Unconfident	Inefficient
Romance		Great	Uncomfortable	Innovative
Self-confidence		Intuitive		OK
Sex		Sexualised		Private
		Straightforward		Straightforward
		Superficial		Superficial
		Unfiltered		
Q6	Q7	Q8	Q9	Q10
Confidence	Boring	Always	less than 1	Yes
Dates	Different info	Never	less than 6	No
Easy dates	Features	Often	less than 12	
Empowerment	Frustrating	Rarely	less than 24	
Experience	Ignored	Sometimes	less than 36	
Home flirting	Impersonal		More than 36	
None	Incompatible people			
Job interview	Objectification			
Language	Offensive behaviour			
Pastime	Prostitution			
Friends	Rejection			
Romance	Superficial			
Sex	Time consuming			
	Too sexual			
	Unpleasant situation			
	Unwanted sex			
	Vulnerable			
Q11	Q12	Q13	Q15	Q16
Blocked	Both	No	Accurate matching	Badoo
Demotivated	Doesn't matter	Yes	Block offences	Happn
Frustrated	Man		I don't care	No
Objectification	No opinion		More feedback	POF
Relationship	Woman		More female users	Tinder
Time consuming			More interaction	
			More match	
			More respect	
			Nothing	
			Not sure	
			Paying features	
			Women were more open	

Table C.1: List of the resulting words of the categorisation of answers in phase 2.

Appendix D

Women's perspectives on Tinder: informative email for participants

Dear participant,

You were selected among key-users to be interviewed (by email). Before you start you must read this document and indicate whether you agree with the terms or not. If you agree, you should reply to this email with all this text below copied in the email body and answer to the confirmation of reading and agreement which is at the very bottom of the document. All the interviews without a clear answer (yes or no) in the participation declaration item will be disregarded. After your positive answer, the interview will be sent in a second email.

Information for participants

Interview topic: women's perspective on using Tinder

This Interview is a fundamental part of academic research to pursue a PhD degree within the School of Computer Science and Statistics of Trinity College Dublin. The goal of this research is to understand how women feel using the Tinder application. Such information will be used for scientific purposes; the research does not represent (and have not been recommended by) Tinder or any other company.

Procedures of this study: I will ask you some questions about your experience while using Tinder and it would be desirable that you give precise answers, since the richer your answers are the richer will be the results.

Recruitment method: The recruitment of volunteers has been planned to happen with help of people I know through my personal Facebook page. You should be aware that I could contact you because I took advantage of my personal relationships: someone recommended you as a possible volunteer or you are a friend of my personal circle and you freely volunteered to participate and contribute to this research.

Volunteer consent: Before start answering the questions, you should be aware that you are being interviewed as an anonymous volunteer, that you are contributing to the findings of the present research and that you will not

be paid for doing this. You have the right to withdraw and omit your responses and feel free to say only what you feel comfortable to.

Duration: The duration of the interview is estimated in between 20-40 minutes.

Risks: This interview present no risks for you and the benefit of volunteering for this project is that you are contributing for a better understanding of women's needs and, consequently, for the development of more inclusive applications for women.

Anonymity: You should not name third parties in any open text field. All such replies will be anonymised. All the results of the interview that will be used in publication will be anonymised.

Illicit activities: You should also be aware that if your answers reveal any illicit activities (as rape, harassment, violence against women, etc) it can be reported to the appropriate authorities.

Data protection: The data will be protected and only the researcher will be able to access that.

Interview method: The interview, along with the participant consent form and the information sheet for participants, will be sent by email with an instruction to read carefully all the information attached and to send it back within a week with an agreement and confirmation of reading all the information along with their answers by email. The email method was chosen because the volunteers will be in different cities and also because I believe that they will feel more comfortable to write it down than to dialogue through speech and that the answers will be more detailed as they have time to think and no pressure to finish it quickly. I will make myself available to clear up any doubts through email.

Debriefing section: I expect to share with you the findings that you made possible in about eight months from now, after having the paper submitted and approved (what will guarantee the confidentiality of this study).

Consent form

Declaration:

I am 18 years or older and am competent to provide consent.

I have read, or had read to me, a document providing information about this research and this consent form.

I have had the opportunity to ask questions and all my questions have been answered to my satisfaction and understand the description of the research that is being provided to me.

I agree that my data is used for scientific purposes and I have no objection that my data is published in scientific publications in a way that does not reveal my identity.

I understand that if I make illicit activities known, these will be reported to appropriate authorities.

I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights. I understand that I may refuse to answer any question and that I may withdraw at any time without penalty.

I understand that my participation is fully anonymous and that no personal details about me will be recorded.
I have received a copy of this agreement.

Statement of investigator's responsibility: I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

Milena Ribeiro Lopes - lopesm@tcd.ie

Appendix E

Study 1: Results - PHASE 1

Q1: Motivations (n=40)		Q7: Negative (n=39)		Q15: Improvements (n=37)	
People/Friends	24 (60%)	Harassment	20 (51%)	Nothing	9 (27%)
Relationship	16 (40%)	Insult	6 (15%)	Filters	9 (24%)
Language	9 (22%)	Sexism	6 (15%)	Better users	3 (8%)
Curiosity	4 (10%)	Low interaction	5 (13%)	+ interaction	3 (8%)
Sex	3 (7%)	Lack of filters	3 (8%)	- Expectation	2 (5%)
Other reasons	1 (2%)	Nothing	3 (8%)	- Hesitation	2 (5%)
Q2: Concerns (n=39)		Superficial	3 (8%)	Find partner	2 (5%)
No	25 (64%)	Other	3 (8%)	Chat	1 (3%)
Yes	14 (36%)	Racism	2 (5%)	Choose name	1 (3%)
Q3a: First impression (n=38)		Repression	2 (5%)	Go back	1 (3%)
Superficial (negative)	10 (26%)	Addiction	1 (3%)	- Superficial	1 (3%)
Exciting (positive)	9 (24%)	Q8: Respected? (n=40)		Limit time/likes	1 (3%)
Unfiltered (negative)	7 (18%)	Always	9 (23%)	+ Patience	1 (3%)
Fun (positive)	7 (18%)	Often	5 (13%)	Q16a: Other apps (n=40)	
Easy (positive)	4 (10%)	Sometimes	12 (30%)	Happn	16 (40%)
Unsafe (negative)	3 (8%)	Rarely	3 (7%)	POF	11 (28%)
Sexualised (negative)	1 (3%)	Never	11 (27%)	No	9 (22%)
Invasive (negative)	1 (3%)	Q9: Usage (n=37)		Badoo	4 (10%)
Q3b: Negative or positive? (n=38)		Up to 6 months	18 (49%)	Ok Cupid	2 (5%)
Negative	20 (53%)	Up to 1 year	7 (19%)	Kick Off	1 (2%)
Positive	18 (47%)	More than 1y	12 (32%)	Lovoo	1 (2%)
Q4: First matches (n=32)		Q10: Uninstalled? (n=39)		Once	1 (2%)
Confident	27 (84%)	Yes	35 (90%)	Yahoo	1 (2%)
Neutral	5 (16%)	No	4 (10%)	Q16b: App preference (n=31)	
Q5: Match system (n=35)		Q11: Reason to uninstall (n=35)		Tinder	11 (36%)
Superficiality	15 (43%)	Relationship	15 (43%)	Happn	6 (19%)
Privacy	11 (31%)	Frustration	15 (43%)	No	5 (16%)
Reciprocity	5 (14%)	Boredom	5 (14%)	POF	4 (13%)
Assertive	4 (11%)	Repression	2 (6%)	Badoo	3 (10%)
Innovative	3 (9%)	Q12: Developer gender (n=34)		Ok Cupid	1 (3%)
Neutral	2 (6%)	Man	29 (85%)	Yahoo	1 (3%)
Empowering	1 (3%)	Both	4 (12%)		
Q6: Positive aspects (n=39)		Woman	1 (3%)		
Friends	26 (67%)	Q13: gender differences (n=40)			
Partner	19 (49%)	M: sex	23 (57%)		
No gain	7 (18%)	W: relationship	17 (43%)		
Tourist info	4 (10%)	No difference	16 (40%)		
Language	3 (8%)				
Fun	3 (8%)				
Self-esteem	2 (5%)				
Empowerment	1 (3%)				

Table E.1: Responses to each question of the interview in phase 1.

Appendix F

Users' experience of Tinder: informed consent

TRINITY COLLEGE DUBLIN | SCHOOL OF COMPUTER SCIENCE AND STATISTICS

Project: Users' perspective on using Tinder

Researcher: Milena Ribeiro Lopes

Supervisor: Carl Vogel

INFORMED CONSENT

How do you feel using Tinder?

Dear participant,

You have already used Tinder, right? If you are comfortable with the information presented here you may proceed to express your consent to participate in this research which is part of a PhD program within the School of Computer Science and Statistics at Trinity College Dublin. We are taking advantage of our personal relationships to recruit participants through online social media. We want to understand how you feel using the Tinder application and to learn more about the relationship between design and the dating experience. The research has scientific purposes and does not represent (and has not been recommended by) Tinder or any other company.

After giving consent, you will anonymously fill in some information before taking the survey that has 16 questions (multiple choice and single answer). The survey is available in English and Brazilian Portuguese. It will take you around 20 minutes to complete. This survey presents no risks. Your participation is voluntary and you won't be paid for doing this. It's desirable that you reply within a week. You can withdraw at any time before submitting your answers, without any prejudice. Once you submit your answers you cannot withdraw because the submission is anonymous.

All your answers (including names of third parties) will be anonymised. The information collected will be used for scientific purposes. You should also be aware that if your answers reveal any illicit activities (as rape, harassment, violence, etc) it can be reported to the appropriate authorities. All the data can be retained for a period of 10 years after the last publication of any scientific findings referring to this research to comply with the Code of Good Research Practice of Trinity College Dublin. The results of this research are expected to be published in scientific conferences

If you have doubts or want to get a feedback on this survey you can contact the principal researcher emailing lopesm@tcd.ie.

By clicking the button below, you acknowledge that your participation in the study is voluntary, you are 18 years or older and competent to give consent, and that you are aware that you won't be paid, that the research doesn't represent any company and present no risks, that you may choose to terminate your participation in the study at any time before submitting your answers without penalty, that your answers and direct quotes will be anonymised, that the data will be used for scientific purposes and published in a way it doesn't reveal your identity, that data can be kept up to 10 years after the last publication, and that you can email the researcher if you have doubts or want to discuss the study.

Statement of investigator's responsibility: I have provided participants with information on the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions by email. I believe that sufficient information has been given in order for the participant to understand the experiment and this freely give informed consent.

Milena Ribeiro Lopes - lopesm@tcd.ie

31th June, 2018

Appendix G

Study 1: Results - PHASE 2

Q1: Motivations	Women (n= 25)	Men (n= 29)	Total (n=54)
Casual	6 (24%)	10 (34%)	16 (30 %)
Curiosity	4 (16%)	5 (17%)	9 (17%)
Pastime	3 (12%)	0	3 (6%)
People/Friends	14 (56%)	17 (59%)	31 (57%)
Romance	11 (44%)	9 (31%)	20 (37%)
Self-confidence	0	2 (7%)	2 (4%)
Sex	0	4 (14%)	4 (7%)
Q2: Concerns	Women (n= 25)	Men (n= 29)	Total (n=54)
No	17 (68%)	22 (76%)	39 (72%)
Yes	8 (32%)	7 (24%)	15 (28%)
Q3a: First impression	Women (n= 24)	Men (n= 29)	Total (n=53)
Addictive (neutral)	0	1 (3%)	1 (2%)
Awkward (negative)	1 (4%)	3 (10%)	4 (8%)
Disappointing (negative)	4 (17%)	2 (7%)	6 (11%)
Exciting (positive)	1 (4%)	4 (14%)	5 (9%)
Fun (positive)	1 (4%)	1 (3%)	2 (4%)
Great (positive)	6 (25%)	7 (24%)	13 (25%)
Intuitive (positive)	1 (4%)	2 (7%)	3 (6%)
Sexualised (negative)	1 (4%)	0	1 (2%)
Straightforward (positive)	1 (4%)	1 (3%)	2 (4%)
Superficial (negative)	6 (25%)	3 (10%)	9 (17%)
Unfiltered (negative)	2 (8%)	4 (14%)	6 (11%)
Q4: First matches	Women (n= 24)	Men (n= 29)	Total (n=53)
Confident	17 (71%)	16 (55%)	33 (62%)
Curious	0	1 (3%)	1 (2%)
Indifferent	1 (4%)	3 (10%)	4 (8%)
Unconfident	0	3 (10%)	3 (6%)
Unrequited	2 (8%)	3 (10%)	5 (9%)
Uncomfortable	4 (17%)	3 (10%)	7 (13%)
Q5: Match system	Women (n= 23)	Men (n= 29)	Total (n=52)
Confusing	0	2 (7%)	2 (4%)
Easy	0	2 (7%)	2 (4%)
Effective	5 (22%)	3 (10%)	8 (15%)
Fun	1 (4%)	2 (7%)	3 (6%)
Inefficient	5 (22%)	6 (21%)	11 (21%)
Innovative	1 (4%)	0	1 (2%)
OK	7 (30%)	7 (24%)	14 (27%)
Private	1 (4%)	0	1 (2%)
Straightforward	1 (4%)	1 (3%)	2 (4%)
Superficial	4 (17%)	6 (21%)	10 (19%)

Table G.1: Responses to questions 1 to 6 of the interview in phase 2.

Q6: Positive aspects	Women (n= 24)	Men (n= 29)	Total (n=53)
Confidence	1 (4%)	1 (3%)	2 (4%)
Dates	1 (4%)	3 (10%)	4 (8%)
Easy dates	1 (4%)	10 (35%)	11 (21%)
Empowerment	2 (8%)	0	2 (4%)
Experience	3 (13%)	2 (7%)	5 (9%)
Home use	0	3 (10%)	3 (6%)
Job interview	1 (4%)	0	1 (2%)
Language	1 (4%)	0	1 (2%)
None	3 (12%)	2 (7%)	5 (9%)
Pastime	3 (12%)	2 (7%)	5 (9%)
People/friends	11 (46%)	11 (38%)	22 (42%)
Romance	7 (29%)	5 (17%)	12 (22%)
Sex	0	1 (3%)	1 (2%)
Q7: Negative aspects	Women (n= 25)	Men (n= 29)	Total (n=54)
Boring	5 (20%)	9 (31%)	13 (24%)
Different information	6 (24%)	5 (17%)	12 (22%)
Features	0	3 (10%)	3 (6%)
Frustrating	0	2 (7%)	2 (4%)
Ignored	0	1 (3%)	1 (2%)
Impersonal	1 (4%)	0	1 (2%)
Incompatible people	3 (12%)	3 (10%)	7 (13%)
Objectification	0	1 (3%)	1 (2%)
Offensive behaviour	7 (28%)	0	7 (13%)
Prostitution	0	1 (3%)	1 (2%)
Rejection	4 (16%)	0	4 (7%)
Superficial	0	3 (10%)	3 (6%)
Time consuming	1 (4%)	2 (7%)	3 (6%)
Too sexual	6 (24%)	0	6 (11%)
Unpleasant situation	3 (12%)	8 (28%)	11 (20%)
Unwanted sex	0	1 (3%)	1 (2%)
Vulnerable	3 (12%)	0	3 (6%)
Q8: Respected?	Women (n= 25)	Men (n= 29)	Total (n=54)
Always	3 (12%)	19 (66%)	22 (41%)
Often	10 (40%)	10 (35%)	20 (37%)
Sometimes	6 (24%)	0	6 (11%)
Rarely	3 (12%)	0	3 (6%)
Never	3 (12%)	0	3 (6%)
Q9: Usage	Women (n= 25)	Men (n= 29)	Total (n=54)
Up to 6 months	11 (44%)	9 (36%)	20 (37%)
Up to 1 year	5 (20%)	4 (14%)	9 (17%)
More than 1 year	9 (36%)	16 (55%)	25 (46%)
Q10: Uninstalled?	Women (n= 25)	Men (n= 29)	Total (n=54)
Yes	21 (84%)	21 (72%)	42 (78%)
No	4 (16%)	8 (28%)	12 (22%)

Table G.2: Responses to questions 6 to 10 of the interview in phase 2.

Q11: Reason to uninstall	Women (n= 22)	Men (n= 21)	Total (n=43)
Blocked	1 (5%)	0	1 (2%)
Demotivated	5 (23%)	4 (19%)	9 (21%)
Frustrated	5 (23%)	3 (14%)	8 (19%)
Objectification	1 (5%)	1 (5%)	2 (5%)
Relationship	10 (45%)	14 (67%)	24 (56%)
Time consuming	2 (9%)	1 (5%)	3 (7%)
Q12: Developer's gender	Women (n= 25)	Men (n= 29)	Total (n=54)
Both (Man & Woman)	0	2 (7%)	2 (4%)
Doesn't matter	0	2 (7%)	2 (4%)
Man	18 (72%)	17 (59%)	35 (65%)
No opinion	4 (16%)	5 (17%)	9 (17%)
Woman	3 (12%)	3 (10%)	6 (11%)
Q13a: Gender differences?	Women (n= 22)	Men (n= 28)	Total (n=50)
Yes	13 (59%)	12 (43%)	25 (50%)
No	8 (36%)	16 (57%)	24 (48%)
I don't know	1 (5%)	0	1 (2%)
Q13b: Which differences?	Women (n= 22)	Men (n= 28)	Total (n=50)
Men look for sex	12 (55%)	10 (36%)	22 (44%)
Women look for relationship	10 (46%)	9 (32%)	19 (38%)
Q15: Improvements	Women (n= 22)	Men (n= 27)	Total (n=49)
Accurate matching	8 (36%)	12 (44%)	20 (41%)
Block offenses	3 (14%)	0	3 (6%)
I don't care	1 (5%)	1 (4%)	2 (4%)
More feedback	0	1 (4%)	1 (2%)
More female users	0	1 (4%)	1 (2%)
More interaction	1 (5%)	2 (7%)	3 (6%)
More matches	0	1 (4%)	1 (2%)
More respect	2 (9%)	1 (4%)	3 (6%)
Nothing	1 (5%)	1 (4%)	2 (4%)
Not sure	6 (27%)	6 (22%)	12 (24%)
Paying features	3 (14%)	2 (7%)	5 (10%)
Women were more open	0	1 (4%)	1 (2%)
Q16a: Other apps?	Women (n= 25)	Men (n= 28)	Total (n=53)
Yes	20 (80%)	22 (79%)	42 (79%)
No	5 (20%)	6 (21%)	11 (21%)
Q16b: Other apps?	Women (n= 13)	Men (n= 21)	Total (n=34)
Badoo	1 (8%)	0	1 (3%)
Happn	3 (23%)	6 (29%)	9 (26%)
No	2 (15%)	2 (10%)	4 (12%)
POF	1 (8%)	1 (5%)	2 (6%)
Tinder	6 (46%)	12 (57%)	18 (53%)

Table G.3: Responses to questions 11 to 16 of the interview in phase 2.

Appendix H

Tinder study: pooled data results

Pooled data (female users of Tinder – phase 1 and 2)		
Question No.	Categories	Chi-squared test (χ^2)
Q1: motivations	Relationship	$\chi^2 = 0.0035636$, df = 1, p-value = 0.9524
	Friends/People	$\chi^2 = 0.0003869$, df = 1, p-value = 0.9843
	Hookup	$\chi^2 = 2.2642$, df = 1, p-value = 0.1324
Q2: concerns	Yes	$\chi^2 = 0.0025574$, df = 1, p-value = 0.9597
	No	$\chi^2 = 0.0025574$, df = 1, p-value = 0.9597
Q3: 1st impression	Negative impression	$\chi^2 = 0.15059$, df = 1, p-value = 0.698
	Positive impression	$\chi^2 = 0$, df = 1, p-value = 1
Q6: Benefits	Relationship	$\chi^2 = 1.6927$, df = 1, p-value = 0.1932
	Friends/People	$\chi^2 = 1.9767$, df = 1, p-value = 0.1597
	Hookup	$\chi^2 = 0.057129$, df = 1, p-value = 0.8111
Q7: Downside	Boring	$\chi^2 = 0.58761$, df = 1, p-value = 0.4433
	Offences	$\chi^2 = 0.011285$, df = 1, p-value = 0.9154
	Too sexual	$\chi^2 = 3.3177$, df = 1, p-value = 0.06854
	Offensive behaviour	$\chi^2 = 9.2954$, df = 1, p-value = 0.002297
Q8: Respect	Always	$\chi^2 = 0.5372$, df = 1, p-value = 0.4636
	Often	$\chi^2 = 5.0965$, df = 1, p-value = 0.02397
	Sometimes	$\chi^2 = 0.058104$, df = 1, p-value = 0.8095
	Rarely	$\chi^2 = 0.02869$, df = 1, p-value = 0.8655
	Never	$\chi^2 = 1.3661$, df = 1, p-value = 0.2425
Q11: Reason to uninstall	Relationship	$\chi^2 = 0.0018676$, df = 1, p-value = 0.9655
	Negative Experience	$\chi^2 = 0.0018676$, df = 1, p-value = 0.9655
Q13: Gender differences	Yes, I perceive	$\chi^2 = 0.0088132$, df = 1, p-value = 0.9252
	No, I don't see differences	$\chi^2 = 0$, df = 1, p-value = 1
	Man: sex	$\chi^2 = 0.016843$, df = 1, p-value = 0.8967
	Women: relationship	$\chi^2 = 0.20273$, df = 1, p-value = 0.6525

Figure H.1: Results of the Chi-squared test for significance in pooled analysis of women's experience of Tinder for phases 1 and 2.

Appendix I

Design bias study: information sheet for participants

TRINITY COLLEGE DUBLIN | SCHOOL OF COMPUTER SCIENCE AND STATISTICS
INFORMATION SHEET FOR PARTICIPANTS

Project: Decision making in the design of mobile application

Researcher: Milena Ribeiro Lopes

Dear participant,

You have volunteered to participate in this research project. Before you start you must read this document and indicate whether you agree with the terms or not.

What is this research for? This user study intends to find patterns in decision making during the definition of requirements in a design project. It is an opportunity to learn about the design methodology and tools to design mobile applications. The data collected will be used for scientific purposes and the research is not conducted for the benefit of any company. The research is part of a PhD project and has been approved by the Research Ethics Committee within the School of Computer Science and Statistics of Trinity College Dublin (SCSS).

Participation and remuneration: The answers you will give will be anonymised. None of the results or publications of this user study will mention your name. You will get €10 voucher if you complete the experiment. You can withdraw at any time before the end of the design session. If you want to withdraw during the design session, inform the researcher about your decision. If you agree to participate, I expect that you are willing to contribute with the research and engage with the experiment.

Procedure and duration: The experiment will last about 15 min. You will read an explanation about the design process and be introduced to some design tools. You will be asked to define the requirements of a design project based on what you've learnt. There are three tasks to complete.

Risks and benefits: This experience presents no obvious risks, and you will learn about the design process and some tools to design graphical user interfaces.

Data protection: Any information obtained from you will be treated confidentially. All the data will be retained for a period of 10 years after the last publication of any scientific findings referring to this research to comply with the Code of Good Research Practice of Trinity College Dublin.

Debriefing section: The results of the research will be available upon request by emailing lopesm@tcd.ie.

Publication: The results of this research are expected to be published in scientific conferences as part of my PhD research within the School of Computer Science and Statistics of Trinity College Dublin.

If you have doubts or want to discuss this research, you can contact the principal researcher emailing lopesm@tcd.ie or PhD supervisor Dr Carl Vogel (vogel@tcd.ie).

Appendix J

Design bias study: informed consent

TRINITY COLLEGE DUBLIN | SCHOOL OF COMPUTER SCIENCE AND STATISTICS

INFORMATION SHEET FOR PARTICIPANTS

Project: Decision making in the design of mobile application

Researcher: Milena Ribeiro Lopes

Participant information

Name:

Student No.:

Course:

Email:

I am 18 years or older and am competent to provide consent.

I freely agree to be part of this research study. I can withdraw at any time without any consequences of any kind. I understand that all my answers will be anonymised.

If I agree to participate and I complete the experiment, I'll receive €10 voucher.

I assert that I will engage with the experiment and not give random answers.

I was informed that this experiment presents no risks.

My personal information and answers to the experiment will be treated confidentially.

I was informed that the research has scientific purposes and does not represent any company.

I agree that the data I produce is used for scientific purposes and published in a way that does not reveal my identity.

If I have questions, I can ask Milena (lopesm@tcd.ie) or her supervisor (vogel@tcd.ie).

I have received a copy of this agreement.

Have you read Information Sheet for Participants and agreed to participate under all the conditions below exposed (Yes/No)?

Participant signature:

Statement of investigator's responsibility: I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions by email. I believe that the participant understands my explanation and is freely giving informed consent.

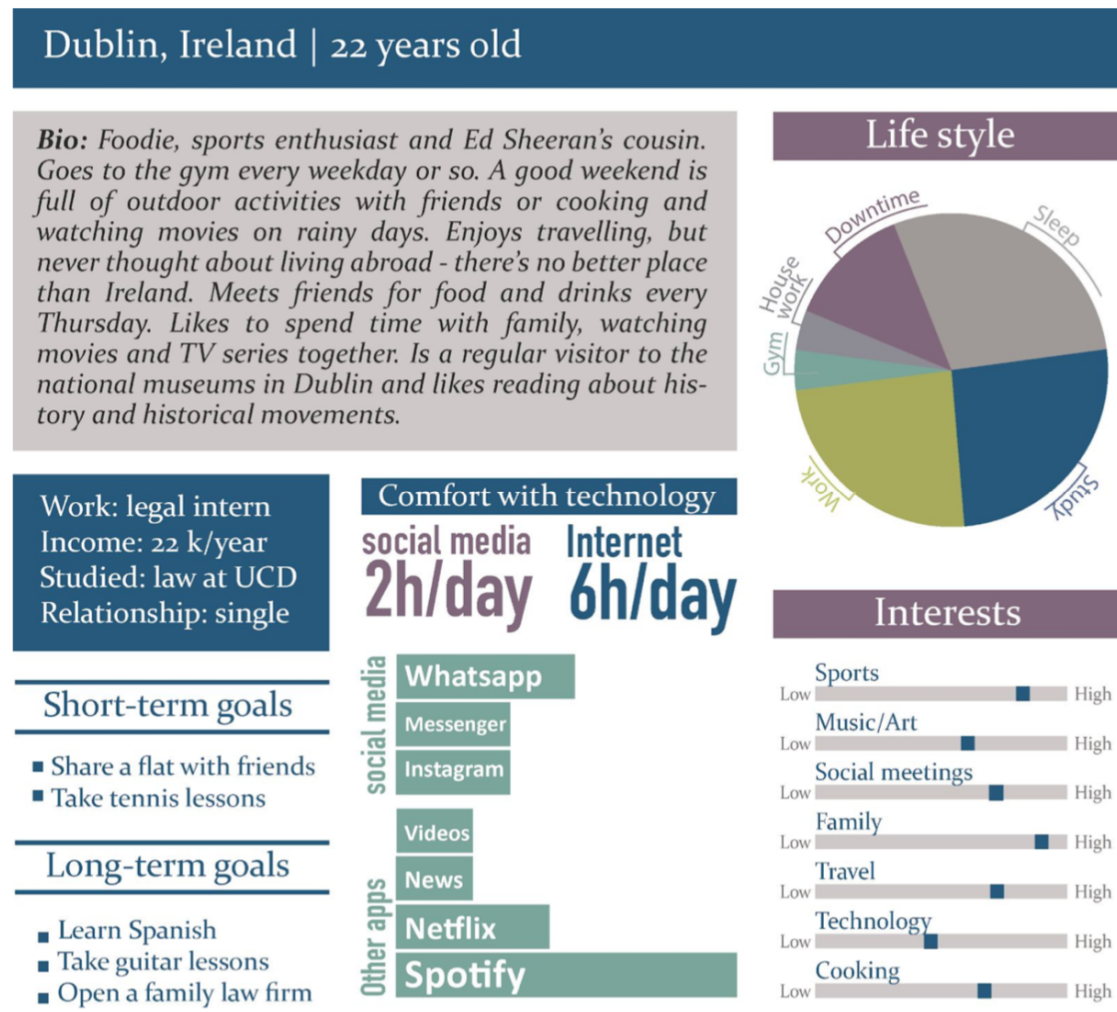
Milena Ribeiro Lopes - lopesm@tcd.ie

Appendix K

Design bias study: persona and scenario

The goal of this user study is to understand personal differences in decision making in the design process. In order to assess those personal differences, participants will make design decisions based on two tools used to describe the user and the user experience: **persona and scenario**. A **persona** is a description of a fictional character based on data collected from real users. A **scenario** is a description of how the user intended to reach their goals through the app. **Decisions must be based on the persona and scenario provided, not on personal preferences.**

Persona: This is the description of the user's personality and lifestyle.



Scenario: This is the persona's description of the context of use and experience of the app.

"I met some friends for a drink the other evening. One of them told me about their experience with this new dating app. I'd never used one before and so had some questions about how it works. My friend opened it there and then to show everybody the main features. I was curious to try it out but not so confident about installing it. My friend let me use it for a few minutes just to get a feel for it. I enjoyed the experience, so when I got back home, I decided to install the app on my own phone, to give it a go. I used the application for half an hour or so and matched with some interesting people. I've been using the app every night since, both to look for new people to match with, and to keep the conversation going with some of those I connected with previously. Everything really seemed to click with this one person, and we have a date coming up next Friday. I'm really looking forward to it."

Figure K.1: Persona and scenario given to participants.

Appendix L

Design bias study: participants' tasks sheet

Task 2: Personality scale

Let's define the **personality of the app**, taking into account the **persona's needs**. When we define the app's personality we define how the system should behave. Do these adjectives describe the preferred dating app behaviour?

	Definitely NOT	Probably NOT	Neutral	Probably YES	Definitely YES
Discreet					
Caring					
Easygoing					
Cheerful					
Open-minded					
Honest					
Creative					
Intriguing					
Down to earth					
Polite					
Flexible					
Straightforward					
Committed					
Reliable					
Engaging					
Proactive					
Spontaneous					

Task 1: Priority setting

Let's define the **ideal experience** of a dating application taking into account the **persona** described. There are 8 words in each column. Sort them by **order of importance**: 1 is the most important and 8 the least important.

Personal information (will be anonymised)

Name and Surname: _____ Age: _____

TCD Number: _____ Gender: Female Male Other

1st Nationality: _____ 2nd Nationality: _____

Experience level: have you ever used a dating app before? YES NO

1 - Most important / 8 - Least important

How should the persona feel?	Which values should be prioritised?	How should the communication feel?
<input type="checkbox"/> Comfortable	<input type="checkbox"/> Empowerment	<input type="checkbox"/> Calm
<input type="checkbox"/> In control	<input type="checkbox"/> Freedom	<input type="checkbox"/> Kind
<input type="checkbox"/> Engaged	<input type="checkbox"/> Privacy	<input type="checkbox"/> Straightforward
<input type="checkbox"/> Safe	<input type="checkbox"/> Honesty	<input type="checkbox"/> Polite
<input type="checkbox"/> Confident	<input type="checkbox"/> Empathy	<input type="checkbox"/> Effective
<input type="checkbox"/> Happy	<input type="checkbox"/> Reciprocity	<input type="checkbox"/> Enthusiastic
<input type="checkbox"/> Respected	<input type="checkbox"/> Self-awareness	<input type="checkbox"/> Playful
<input type="checkbox"/> Appreciated	<input type="checkbox"/> Equality	<input type="checkbox"/> Adventurous

Figure L.1: Task sheet: first page.

Task 3: Features

Which features are important in order to best provide the persona with a good experience of a dating application? Choices should not be based on personal preferences but on the persona's needs.

Feature	Function	Not important	Less important	Important	Very important	Strictly necessary
Join a group	Users can find all those with one common interest in the same place.					
Relationship mode	Users can filter by motivation and quickly find those looking for a relationship.					
Time is ticking	Users have to engage more with their matches or lose them due to inactivity.					
Gift voucher	Users can help a friend who needs an extra push by giving them a voucher for paid features.					
Stay safe	Users can find protocols and features that help them to stay safe during encounters.					
Self-awareness	Users can get statistical reports to better understand what they're doing wrong and well.					
Chemistry	Users can enable video and voice features to get to know their matches better before meeting.					
Match boost	Users can define their preferences and let the system give likes on their behalf.					
Smart move	Users can get tips to improve conversation and keep matches interested in them.					
Flirting tips	Users can get tips to improve their confidence and approach.					
Rate users	Good behaviour gets more visibility; bad behaviour gets penalties.					
Common interests	The more they have in common, the more visible their profiles will be to each other.					

...three more questions:

Was it easy or difficult to make decisions without taking your own personal preferences, beliefs and previous experience into consideration?

Easy Difficult Medium

Did you notice that we did not specify the gender of the persona?

Yes, I noticed
 No, I didn't notice

Which gender came to your mind when you read about the persona and during the completion of the tasks?

Figure L.2: Task sheet: second page.

Appendix M

Design bias study: TCD results -

Summary

FEMALE PERSONA TCD

Task	Design Elements	Min	1 st Qu.	Median	Mean	3 rd Qu.	Max	NA
T1: feeling	Comfortable	1.000	1.000	2.000	2.586	4.000	5.000	
	In control	1.000	2.000	5.000	4.414	6.000	8.000	
	Engaged	1.000	2.000	6.000	4.966	7.000	8.000	
	Safe	1.000	1.000	2.000	2.931	4.000	8.000	
	Confident	2.000	3.000	4.000	4.552	6.000	8.000	
	Happy	1.000	4.000	6.000	5.276	6.000	8.000	
	Respected	2.000	3.000	4.000	4.586	6.000	8.000	
	Appreciated	3.000	5.000	7.000	6.517	8.000	8.000	
T1: value	Empowerment	2.000	4.000	5.000	5.138	6.000	8.000	
	Freedom	1.000	2.000	3.000	3.414	5.000	7.000	
	Privacy	1.000	1.000	2.000	2.552	3.000	8.000	
	Honesty	1.000	1.000	3.000	3.759	7.000	8.000	
	Empathy	3.000	5.000	6.000	6.069	7.000	9.000	
	Reciprocity	4.000	6.000	7.000	6.931	8.000	8.000	
	Self-awareness	1.000	4.000	5.000	4.897	6.000	8.000	
	Equality	1.000	3.000	3.000	3.414	4.000	7.000	
T1: communication	Calm	1.000	2.000	4.000	4.172	6.000	8.000	
	Kind	1.000	2.000	4.000	4.000	6.000	8.000	
	Straightforward	1.000	3.000	5.000	5.000	8.000	8.000	
	Polite	1.000	2.000	4.000	4.310	7.000	8.000	
	Effective	1.000	3.000	5.000	4.517	6.000	8.000	
	Enthusiastic	1.000	2.000	4.000	4.034	5.000	8.000	
	Playful	1.000	2.000	5.000	4.276	6.000	7.000	
	Adventurous	1.000	4.000	6.000	5.310	6.000	8.000	
T2: personality	Discreet	1.000	3.000	4.000	3.536	4.000	5.000	1
	Caring	2.000	3.000	4.000	3.714	4.000	5.000	1
	Easygoing	3.000	4.000	4.000	4.103	5.000	5.000	
	Cheerful	3.000	4.000	4.000	4.172	5.000	5.000	
	Openminded	2.000	4.000	4.000	4.241	5.000	5.000	
	Honest	2.000	3.000	4.000	4.138	5.000	5.000	
	Creative	2.000	3.000	4.000	3.793	4.000	5.000	
	Intriguing	2.000	4.000	4.000	4.138	5.000	5.000	
	Down to earth	2.000	3.000	3.000	3.276	4.000	5.000	
	Respectful	2.000	3.000	4.000	3.517	4.000	5.000	
	Flexible	3.000	3.750	4.000	4.000	4.250	5.000	1
	Direct	2.000	3.000	4.000	3.931	5.000	5.000	
	Committed	1.000	3.000	3.000	3.276	4.000	5.000	
	Reliable	3.000	4.000	4.000	4.310	5.000	5.000	
	Engaging	3.000	4.000	4.000	4.379	5.000	5.000	
	Proactive	2.000	3.000	4.000	3.724	4.000	5.000	
Spontaneous	1.000	3.000	4.000	3.448	4.000	5.000		
T3: features	Join a group	2.000	2.000	3.000	3.276	4.000	5.000	
	Relationship mode	1.000	2.000	4.000	3.276	4.000	5.000	
	Time is ticking	1.000	2.000	3.000	2.759	3.000	5.000	
	Gift voucher	1.000	2.000	2.000	2.276	3.000	5.000	
	Stay safe	2.000	3.000	4.000	4.000	5.000	5.000	1
	Self-report	2.000	2.000	3.500	3.464	4.250	5.000	1
	Chemistry	2.000	3.000	4.000	3.500	4.000	5.000	1
	Match boost	1.000	2.000	3.000	3.207	4.000	5.000	
	Smart move	1.000	2.000	3.000	2.931	4.000	5.000	
	Flirting tips	1.000	2.000	3.000	3.286	4.000	5.000	1
	Rate users	2.000	3.000	4.000	3.517	4.000	5.000	
Common interests	2.000	3.000	4.000	3.690	4.000	5.000		

■ Highest priority ■ Lowest priority

Figure M.1: TCD results for a persona perceived as a woman

FEMALE DESIGNER TCD

Task	Design Elements	Min	1 st Qu.	Median	Mean	3 rd Qu.	Max	NA
T1: feeling	Comfortable	1.000	2.000	2.500	2.786	3.250	6.000	
	In control	1.000	4.000	5.000	4.857	6.000	8.000	
	Engaged	1.000	3.000	5.000	5.000	7.000	8.000	
	Safe	1.000	1.000	1.500	2.964	5.000	8.000	
	Confident	1.000	2.000	4.000	4.179	6.000	8.000	
	Happy	2.000	4.000	5.000	4.929	6.000	8.000	
	Respected	2.000	3.000	4.000	4.571	6.000	7.000	
	Appreciated	2.000	5.750	7.000	6.714	8.000	8.000	
T1: value	Empowerment	1.000	4.000	6.000	5.571	8.000	8.000	
	Freedom	1.000	2.000	4.000	4.071	5.500	8.000	
	Privacy	1.000	1.000	2.000	2.929	4.000	8.000	
	Honesty	1.000	1.000	2.000	2.571	3.000	7.000	
	Empathy	1.000	4.000	6.000	5.357	7.000	8.000	
	Reciprocity	1.000	4.750	6.000	5.714	8.000	8.000	
	Self-awareness	1.000	4.000	5.500	5.250	6.250	8.000	
	Equality	1.000	3.000	4.500	4.536	6.000	8.000	
T1: communication	Calm	2.000	4.750	6.000	5.964	8.000	8.000	
	Kind	1.000	3.000	4.000	4.357	6.000	8.000	
	Straightforward	1.000	1.750	5.000	4.607	7.000	8.000	
	Polite	1.000	3.000	5.000	4.786	7.000	8.000	
	Effective	1.000	3.000	4.000	4.107	5.000	8.000	
	Enthusiastic	1.000	1.000	2.500	3.321	5.000	8.000	
	Playful	1.000	2.000	3.000	3.964	6.000	7.000	
	Adventurous	1.000	3.000	5.000	4.786	6.000	8.000	
T2: personality	Discreet	1.000	3.000	3.000	3.296	4.000	5.000	1
	Caring	2.000	3.000	4.000	3.370	4.000	5.000	1
	Easygoing	1.000	4.000	4.000	4.071	4.250	5.000	
	Cheerful	3.000	4.000	4.000	4.250	5.000	5.000	
	Openminded	2.000	4.000	4.500	4.250	5.000	5.000	
	Honest	1.000	3.000	5.000	4.179	5.000	5.000	
	Creative	2.000	3.000	4.000	3.857	5.000	5.000	
	Intriguing	2.000	4.000	4.000	4.179	5.000	5.000	
	Down to earth	2.000	3.000	3.500	3.643	5.000	5.000	
	Respectful	2.000	3.000	4.000	3.607	4.000	5.000	
	Flexible	2.000	3.750	4.000	3.929	4.000	5.000	
	Direct	2.000	3.750	4.000	3.893	4.000	5.000	
	Committed	1.000	2.750	3.000	3.179	4.000	5.000	
	Reliable	2.000	4.000	4.000	4.214	5.000	5.000	
	Engaging	3.000	4.000	5.000	4.500	5.000	5.000	
	Proactive	2.000	3.000	4.000	3.750	4.250	5.000	
	Spontaneous	2.000	3.000	4.000	3.714	4.250	5.000	
T3: features	Join a group	1.000	3.000	3.500	3.464	4.000	5.000	
	Relationship mode	1.000	2.000	3.000	3.107	4.000	5.000	
	Time is ticking	1.000	2.000	3.000	2.643	3.000	5.000	
	Gift voucher	1.000	2.000	2.000	2.393	3.000	5.000	
	Stay safe	2.000	3.000	4.000	4.000	5.000	5.000	
	Self-report	1.000	2.000	4.000	3.259	4.000	5.000	1
	Chemistry	1.000	2.750	3.000	3.143	4.000	5.000	
	Match boost	1.000	2.000	2.000	2.852	4.000	5.000	1
	Smart move	1.000	2.000	3.000	3.037	4.000	5.000	1
	Flirting tips	1.000	2.000	3.000	3.074	4.000	5.000	1
	Rate users	1.000	2.000	3.000	2.857	4.000	5.000	
	Common interests	2.000	4.000	4.000	4.036	5.000	5.000	

■ Highest priority ■ Lowest priority

Figure M.2: TCD results for women designers

MALE PERSONA TCD

Task	Design Elements	Min	1 st Qu.	Median	Mean	3 rd Qu.	Max	NA
T1: feeling	Comfortable	1.000	2.000	3.000	3.444	5.000	8.000	
	In control	1.000	3.000	5.000	4.815	7.000	8.000	
	Engaged	1.000	2.500	4.000	4.667	7.000	8.000	
	Safe	1.000	1.000	2.000	3.704	6.500	8.000	
	Confident	1.000	2.000	3.000	3.593	5.000	8.000	
	Happy	1.000	3.000	4.000	4.222	6.000	7.000	
	Respected	1.000	3.500	5.000	4.815	6.000	8.000	
	Appreciated	1.000	6.000	7.000	6.519	8.000	8.000	
T1: value	Empowerment	1.000	3.000	6.000	5.000	7.000	8.000	
	Freedom	1.000	3.000	4.000	4.444	6.000	8.000	
	Privacy	1.000	2.000	3.000	3.926	6.000	8.000	
	Honesty	1.000	2.000	2.000	2.815	4.500	7.000	
	Empathy	1.000	3.000	4.000	4.593	6.500	8.000	
	Reciprocity	1.000	4.000	5.000	4.852	6.000	8.000	
	Self-awareness	1.000	3.500	6.000	5.185	7.000	8.000	
	Equality	1.000	3.000	5.000	5.185	7.000	8.000	
T1: communication	Calm	1.000	4.000	6.000	5.296	7.000	8.000	
	Kind	1.000	3.000	5.000	4.519	6.000	8.000	
	Straightforward	1.000	2.000	5.000	4.704	7.000	8.000	
	Polite	1.000	4.000	6.000	5.519	7.000	8.000	
	Effective	1.000	3.000	4.000	4.444	5.500	8.000	
	Enthusiastic	1.000	1.000	3.000	3.407	5.500	7.000	
	Playful	1.000	2.000	3.000	3.333	5.000	8.000	
	Adventurous	1.000	2.500	4.000	4.704	7.500	8.000	
T2: personality	Discreet	1.000	2.000	3.000	2.852	4.000	5.000	
	Caring	2.000	2.000	3.000	3.000	4.000	5.000	
	Easygoing	1.000	4.000	4.000	4.037	4.500	5.000	
	Cheerful	3.000	4.000	4.000	4.074	5.000	5.000	
	Openminded	2.000	3.500	4.000	4.000	5.000	5.000	
	Honest	1.000	2.500	4.000	3.593	5.000	5.000	
	Creative	1.000	3.000	4.000	3.815	5.000	5.000	
	Intriguing	2.000	3.500	4.000	4.111	5.000	5.000	
	Down to earth	2.000	3.000	4.000	3.556	4.500	5.000	
	Respectful	2.000	3.000	4.000	3.407	4.000	5.000	
	Flexible	2.000	3.000	4.000	3.885	4.750	5.000	1
	Direct	2.000	3.000	4.000	3.815	4.000	5.000	
	Committed	1.000	2.000	3.000	2.852	4.000	5.000	
	Reliable	1.000	3.000	4.000	3.963	5.000	5.000	
	Engaging	3.000	4.000	5.000	4.481	5.000	5.000	
	Proactive	2.000	3.000	3.000	3.481	4.000	5.000	
Spontaneous	1.000	3.000	4.000	3.667	4.500	5.000		
T3: features	Join a group	1.000	3.000	4.000	3.481	4.000	5.000	
	Relationship mode	1.000	2.500	4.000	3.519	4.000	5.000	
	Time is ticking	1.000	2.000	3.000	2.630	3.500	5.000	
	Gift voucher	1.000	2.000	2.000	2.593	3.500	5.000	
	Stay safe	1.000	3.000	4.000	3.815	5.000	5.000	
	Self-report	1.000	3.000	4.000	3.444	4.000	5.000	
	Chemistry	1.000	2.000	3.000	3.111	4.000	5.000	
	Match boost	1.000	1.250	2.000	2.731	4.000	5.000	1
	Smart move	1.000	3.000	3.000	3.240	4.000	5.000	2
	Flirting tips	1.000	3.000	3.000	3.231	4.000	5.000	1
	Rate users	1.000	2.000	3.000	2.815	4.000	5.000	
Common interests	1.000	4.000	4.000	4.148	5.000	5.000		

■ Highest priority ■ Lowest priority

Figure M.3: TCD results for a persona perceived as a man

MALE DESIGNER TCD

Task	Design Elements	Min	1 st Qu.	Median	Mean	3 rd Qu.	Max	NA
T1: feeling	Comfortable	1.000	2.000	3.000	3.214	5.000	8.000	
	In control	1.000	2.000	4.500	4.357	6.250	8.000	
	Engaged	1.000	2.000	4.500	4.643	7.250	8.000	
	Safe	1.000	1.000	3.000	3.643	6.000	8.000	
	Confident	1.000	3.000	4.000	4.000	5.000	8.000	
	Happy	1.000	3.000	5.000	4.607	6.000	8.000	
	Respected	1.000	4.000	5.000	4.821	6.000	8.000	
	Appreciated	1.000	5.000	7.000	6.321	8.000	8.000	
T1: value	Empowerment	1.000	2.750	5.000	4.571	6.000	8.000	
	Freedom	1.000	2.000	4.000	3.750	5.250	8.000	
	Privacy	1.000	1.000	2.500	3.500	6.000	8.000	
	Honesty	1.000	2.000	3.000	4.036	7.000	8.000	
	Empathy	1.000	4.000	6.000	5.357	7.000	9.000	
	Reciprocity	3.000	5.000	6.000	6.143	7.250	8.000	
	Self-awareness	1.000	3.000	4.000	4.821	7.000	8.000	
	Equality	1.000	3.000	3.000	4.000	6.000	8.000	
T1: communication	Calm	1.000	1.750	3.000	3.464	5.000	7.000	
	Kind	1.000	2.000	4.500	4.143	6.000	8.000	
	Straightforward	1.000	3.000	5.000	5.107	7.250	8.000	
	Polite	1.000	3.000	5.500	5.000	7.000	8.000	
	Effective	1.000	3.000	5.000	4.857	7.000	8.000	
	Enthusiastic	1.000	2.000	4.000	4.143	6.000	8.000	
	Playful	1.000	2.000	3.000	3.679	5.250	8.000	
	Adventurous	1.000	3.750	5.000	5.250	8.000	8.000	
T2: personality	Discreet	1.000	2.000	3.000	3.107	4.000	5.000	
	Caring	2.000	2.750	3.000	3.357	4.000	5.000	
	Easygoing	3.000	4.000	4.000	4.071	5.000	5.000	
	Cheerful	3.000	4.000	4.000	4.000	4.000	5.000	
	Openminded	2.000	4.000	4.000	4.000	5.000	5.000	
	Honest	1.000	2.750	4.000	3.571	5.000	5.000	
	Creative	1.000	3.000	4.000	3.750	4.000	5.000	
	Intriguing	2.000	3.750	4.000	4.071	5.000	5.000	
	Down to earth	2.000	2.750	3.000	3.179	4.000	5.000	
	Respectful	2.000	3.000	3.000	3.321	4.000	5.000	
	Flexible	2.000	3.000	4.000	3.962	5.000	5.000	2
	Direct	2.000	3.000	4.000	3.857	5.000	5.000	
	Committed	1.000	2.000	3.000	2.964	4.000	5.000	
	Reliable	1.000	4.000	4.000	4.071	5.000	5.000	
	Engaging	3.000	4.000	4.000	4.357	5.000	5.000	
	Proactive	2.000	3.000	3.000	3.464	4.000	5.000	
	Spontaneous	1.000	2.750	4.000	3.393	4.000	5.000	
	T3: features	Join a group	2.000	2.000	3.000	3.286	4.000	5.000
Relationship mode		1.000	3.750	4.000	3.679	4.000	5.000	
Time is ticking		1.000	2.000	3.000	2.750	3.250	5.000	
Gift voucher		1.000	2.000	2.000	2.464	3.250	5.000	
Stay safe		1.000	3.000	4.000	3.815	5.000	5.000	1
Self-report		2.000	3.000	4.000	3.643	4.000	5.000	
Chemistry		2.000	3.000	4.000	3.481	4.000	5.000	1
Match boost		1.000	1.000	3.500	3.107	4.000	5.000	
Smart move		1.000	2.000	3.000	3.111	4.000	5.000	1
Flirting tips		1.000	3.000	3.000	3.444	4.000	5.000	1
Rate users		1.000	2.750	4.000	3.500	4.250	5.000	
Common interests		1.000	3.000	4.000	3.786	5.000	5.000	

■ Highest priority ■ Lowest priority

Figure M.4: TCD results for men designers

Appendix N

Design bias study: NCAD results -

Summary

FEMALE PERSONA NCAD

Task	Design Elements	Min	1 st Qu.	Median	Mean	3 rd Qu.	Max	NA
T1: feeling	Comfortable	1.000	2.000	2.000	3.182	4.000	8.000	
	In control	2.000	4.500	5.000	5.364	6.500	8.000	
	Engaged	2.000	3.000	6.000	5.000	6.500	8.000	
	Safe	1.000	1.000	1.000	2.364	2.000	8.000	
	Confident	2.000	3.500	4.000	4.636	6.000	8.000	
	Happy	2.000	4.000	5.000	4.818	5.500	7.000	
	Respected	1.000	3.000	4.000	4.364	6.000	8.000	
	Appreciated	4.000	6.500	7.000	6.818	8.000	8.000	
T1: value	Empowerment	1.000	3.500	6.000	5.182	7.000	8.000	
	Freedom	1.000	3.500	5.000	4.909	7.000	7.000	
	Privacy	1.000	2.000	2.000	3.182	4.000	8.000	
	Honesty	1.000	2.000	2.000	2.455	3.000	4.000	
	Empathy	3.000	4.000	5.000	4.909	5.500	8.000	
	Reciprocity	1.000	4.500	6.000	5.727	8.000	8.000	
	Self-awareness	1.000	4.000	5.000	5.182	6.500	8.000	
	Equality	1.000	3.000	5.000	4.455	6.000	8.000	
T1: communication	Calm	1.000	3.500	5.000	4.636	5.500	8.000	
	Kind	2.000	4.500	5.000	5.182	6.500	8.000	
	Straightforward	1.000	3.500	6.000	5.091	7.000	8.000	
	Polite	1.000	2.000	3.000	3.727	5.500	8.000	
	Effective	1.000	5.000	7.000	6.000	8.000	8.000	
	Enthusiastic	1.000	2.500	4.000	3.727	4.500	7.000	
	Playful	1.000	1.000	3.000	3.182	5.000	6.000	
	Adventurous	2.000	3.000	3.000	4.455	6.500	8.000	
T2: personality	Discreet	2.000	3.000	4.000	3.636	4.000	5.000	
	Caring	2.000	3.000	4.000	3.545	4.000	4.000	
	Easygoing	2.000	4.000	4.000	4.091	5.000	5.000	
	Cheerful	1.000	3.000	4.000	3.727	4.500	5.000	
	Openminded	2.000	3.000	4.000	3.818	5.000	5.000	
	Honest	4.000	5.000	5.000	4.909	5.000	5.000	
	Creative	2.000	3.000	4.000	3.727	4.500	5.000	
	Intriguing	2.000	3.000	4.000	3.909	5.000	5.000	
	Down to earth	2.000	3.000	4.000	3.636	4.000	5.000	
	Respectful	3.000	3.500	4.000	3.909	4.000	5.000	
	Flexible	2.000	3.000	3.000	3.545	4.000	5.000	
	Direct	3.000	3.000	4.000	3.818	4.500	5.000	
	Committed	1.000	2.000	3.000	3.000	3.500	5.000	
	Reliable	2.000	4.000	4.000	4.091	5.000	5.000	
	Engaging	2.000	4.000	5.000	4.364	5.000	5.000	
	Proactive	1.000	3.000	3.000	3.273	4.000	5.000	
	Spontaneous	1.000	3.000	3.000	3.273	4.000	5.000	
	T3: features	Join a group	2.000	3.000	3.000	3.545	4.500	5.000
Relationship mode		2.000	3.000	4.000	3.545	4.000	5.000	
Time is ticking		1.000	2.000	2.000	2.455	3.000	4.000	
Gift voucher		1.000	2.000	2.000	2.182	2.500	3.000	
Stay safe		1.000	4.000	4.000	3.909	5.000	5.000	
Self-report		1.000	2.000	2.000	2.636	3.500	5.000	
Chemistry		2.000	3.000	3.000	3.273	4.000	5.000	
Match boost		1.000	1.500	2.000	2.091	2.500	4.000	
Smart move		1.000	2.000	2.000	2.545	3.000	5.000	
Flirting tips		1.000	2.500	3.000	2.909	3.000	5.000	
Rate users		1.000	2.000	3.000	2.545	3.000	4.000	
Common interests		2.000	3.500	4.000	4.000	5.000	5.000	

■ Highest priority ■ Lowest priority

Figure N.1: NCAD results for a persona perceived as a woman

FEMALE DESIGNER NCAD

Task	Design Elements	Min	1 st Qu.	Median	Mean	3 rd Qu.	Max	NA
T1: feeling	Comfortable	1.000	1.000	2.000	2.545	3.000	7.000	
	In control	1.000	4.000	5.000	5.273	7.000	8.000	
	Engaged	1.000	3.000	5.000	4.864	7.500	8.000	
	Safe	1.000	1.250	3.000	3.636	5.000	8.000	
	Confident	1.000	2.000	4.000	3.864	5.000	8.000	
	Happy	1.000	4.000	5.000	4.818	6.000	7.000	
	Respected	2.000	3.000	4.000	4.818	7.000	8.000	
	Appreciated	2.000	6.000	6.500	6.227	7.750	8.000	
T1: value	Empowerment	1.000	4.000	6.000	5.273	7.000	8.000	
	Freedom	1.000	3.000	4.000	4.182	6.000	7.000	
	Privacy	1.000	1.000	2.000	3.273	6.750	8.000	
	Honesty	1.000	2.000	3.000	3.409	4.750	6.000	
	Empathy	1.000	3.250	5.000	4.545	5.000	8.000	
	Reciprocity	1.000	3.000	6.000	5.455	8.000	8.000	
	Self-awareness	1.000	4.000	5.500	5.227	7.000	8.000	
	Equality	1.000	3.000	4.500	4.636	7.000	8.000	
T1: communication	Calm	1.000	3.250	5.500	4.955	6.750	8.000	
	Kind	1.000	2.000	5.000	4.000	5.000	7.000	
	Straightforward	1.000	2.000	4.000	4.182	6.000	8.000	
	Polite	1.000	2.000	3.000	3.727	5.750	8.000	
	Effective	1.000	3.000	7.000	5.409	7.000	8.000	
	Enthusiastic	1.000	2.250	4.000	4.455	6.750	8.000	
	Playful	2.000	3.000	4.000	4.227	5.750	7.000	
	Adventurous	2.000	3.250	5.500	5.318	6.750	8.000	
T2: personality	Discreet	1.000	3.000	3.500	3.318	4.000	5.000	
	Caring	2.000	3.000	4.000	3.667	4.000	5.000	1
	Easygoing	3.000	4.000	5.000	4.591	5.000	5.000	
	Cheerful	3.000	4.000	4.000	4.091	5.000	5.000	
	Openminded	2.000	3.000	4.000	3.909	5.000	5.000	
	Honest	2.000	4.000	5.000	4.500	5.000	5.000	
	Creative	2.000	3.000	3.500	3.500	4.000	5.000	
	Intriguing	1.000	3.000	4.000	3.727	5.000	5.000	
	Down to earth	1.000	3.000	3.000	3.409	4.000	5.000	
	Respectful	2.000	3.000	4.000	3.818	4.000	5.000	
	Flexible	3.000	3.000	4.000	3.818	4.000	5.000	
	Direct	2.000	3.250	4.000	4.091	5.000	5.000	
	Committed	2.000	2.000	3.000	2.773	3.000	5.000	
	Reliable	2.000	3.000	4.000	4.000	5.000	5.000	
	Engaging	2.000	4.000	4.000	4.273	5.000	5.000	
	Proactive	2.000	3.000	3.000	3.636	5.000	5.000	
Spontaneous	1.000	3.000	3.000	3.182	4.000	4.000		
T3: features	Join a group	1.000	3.000	3.000	3.409	4.000	5.000	
	Relationship mode	2.000	3.000	3.500	3.455	4.000	5.000	
	Time is ticking	1.000	2.000	2.000	2.500	3.000	5.000	
	Gift voucher	1.000	2.000	2.000	2.273	3.000	5.000	
	Stay safe	1.000	3.000	4.000	3.773	5.000	5.000	
	Self-report	1.000	2.000	2.000	2.455	3.000	4.000	
	Chemistry	2.000	3.000	3.000	3.273	4.000	5.000	
	Match boost	1.000	2.000	3.000	2.727	3.000	5.000	
	Smart move	1.000	2.000	3.000	2.545	3.000	4.000	
	Flirting tips	1.000	2.000	3.000	2.727	3.000	4.000	
	Rate users	1.000	2.000	3.000	2.952	4.000	5.000	1
	Common interests	2.000	3.250	4.000	4.091	5.000	5.000	

■ Highest priority ■ Lowest priority

Figure N.2: NCAD results for women designers

MALE PERSONA NCAD

Task	Design Elements	Min	1 st Qu.	Median	Mean	3 rd Qu.	Max	NA
T1: feeling	Comfortable	1.000	1.000	2.000	2.686	4.000	7.000	
	In control	1.000	3.000	5.000	5.200	7.000	8.000	
	Engaged	1.000	2.500	5.000	4.886	7.000	8.000	
	Safe	1.000	2.000	4.000	3.914	5.000	8.000	
	Confident	1.000	3.000	4.000	4.171	5.500	8.000	
	Happy	1.000	2.000	5.000	4.229	6.000	8.000	
	Respected	2.000	3.000	5.000	4.886	6.500	8.000	
	Appreciated	2.000	5.000	6.000	6.057	8.000	8.000	
T1: value	Empowerment	1.000	5.000	6.000	5.829	7.500	8.000	
	Freedom	1.000	2.000	4.000	3.886	5.500	7.000	
	Privacy	1.000	1.000	1.000	3.286	6.500	8.000	
	Honesty	1.000	2.000	3.000	3.086	4.000	6.000	
	Empathy	1.000	2.500	5.000	4.543	6.000	8.000	
	Reciprocity	1.000	4.000	6.000	5.886	8.000	8.000	
	Self-awareness	1.000	4.000	5.000	5.029	7.000	8.000	
	Equality	1.000	3.000	4.000	4.457	6.000	8.000	
T1: communication	Calm	1.000	3.500	6.000	5.114	7.500	8.000	
	Kind	1.000	3.000	4.000	4.114	5.000	7.000	
	Straightforward	1.000	2.000	5.000	4.857	7.000	8.000	
	Polite	1.000	3.000	3.000	4.086	6.000	8.000	
	Effective	1.000	4.500	6.000	5.543	7.000	8.000	
	Enthusiastic	1.000	2.000	4.000	4.029	6.000	8.000	
	Playful	1.000	2.000	3.000	3.857	5.000	8.000	
	Adventurous	1.000	2.000	5.000	4.514	6.000	8.000	
T2: personality	Discreet	1.000	3.000	4.000	3.571	4.000	5.000	
	Caring	1.000	3.000	4.000	3.588	4.000	5.000	1
	Easygoing	2.000	4.000	5.000	4.314	5.000	5.000	
	Cheerful	3.000	3.250	4.000	4.029	5.000	5.000	1
	Openminded	2.000	3.000	4.000	3.914	5.000	5.000	
	Honest	2.000	4.000	4.000	4.343	5.000	5.000	
	Creative	1.000	2.000	3.000	3.200	4.000	5.000	
	Intriguing	1.000	3.000	4.000	3.571	4.000	5.000	
	Down to earth	1.000	3.000	3.000	3.514	4.000	5.000	
	Respectful	2.000	3.000	4.000	3.829	4.000	5.000	
	Flexible	2.000	3.000	4.000	3.743	4.000	5.000	
	Direct	2.000	3.000	4.000	3.971	5.000	5.000	
	Committed	1.000	2.000	3.000	2.886	3.500	5.000	
	Reliable	2.000	3.000	4.000	3.829	5.000	5.000	
	Engaging	2.000	4.000	4.000	4.057	5.000	5.000	
	Proactive	2.000	3.000	4.000	3.714	5.000	5.000	
	Spontaneous	1.000	2.500	4.000	3.343	4.000	5.000	
T3: features	Join a group	1.000	3.000	3.000	3.294	4.000	5.000	1
	Relationship mode	1.000	3.000	3.000	3.286	4.000	5.000	
	Time is ticking	1.000	2.000	3.000	2.971	4.000	5.000	
	Gift voucher	1.000	1.500	2.000	2.171	3.000	5.000	
	Stay safe	1.000	3.000	4.000	3.600	5.000	5.000	
	Self-report	1.000	2.000	3.000	2.771	3.000	5.000	
	Chemistry	2.000	3.000	3.000	3.200	4.000	5.000	
	Match boost	1.000	2.000	3.000	2.657	3.000	5.000	
	Smart move	1.000	2.000	3.000	2.771	3.000	4.000	
	Flirting tips	1.000	2.000	3.000	2.857	3.000	4.000	
	Rate users	1.000	2.000	3.000	3.294	4.750	5.000	1
	Common interests	1.000	4.000	4.000	4.029	5.000	5.000	

■ Highest priority ■ Lowest priority

Figure N.3: NCAD results for a persona perceived as a man.

MALE DESIGNER NCAD

Task	Comfortable	Min	1 st Qu.	Median	Mean	3 rd Qu.	Max	NA
T1: feeling	Comfortable	1.000	1.000	2.000	2.926	4.500	8.000	
	In control	1.000	3.000	5.000	5.074	7.000	8.000	
	Engaged	1.000	3.000	6.000	5.148	7.000	8.000	
	Safe	1.000	1.000	4.000	3.556	5.000	8.000	
	Confident	1.000	3.500	5.000	4.815	6.000	8.000	
	Happy	1.000	2.000	4.000	4.037	6.000	8.000	
	Respected	1.000	3.000	5.000	4.444	6.000	8.000	
	Appreciated	3.000	4.500	7.000	6.222	8.000	8.000	
T1: value	Empowerment	1.000	5.000	7.000	6.074	8.000	8.000	
	Freedom	1.000	2.000	4.000	4.074	5.500	7.000	
	Privacy	1.000	1.000	3.000	3.519	6.000	8.000	
	Honesty	1.000	1.500	2.000	2.370	3.000	4.000	
	Empathy	2.000	3.000	4.000	4.556	6.500	8.000	
	Reciprocity	1.000	5.000	6.000	6.185	8.000	8.000	
	Self-awareness	1.000	4.000	5.000	5.000	6.000	8.000	
	Equality	1.000	3.000	4.000	4.222	6.000	8.000	
T1: communication	Calm	1.000	3.000	5.000	4.778	6.500	8.000	
	Kind	2.000	3.000	5.000	4.593	6.000	8.000	
	Straightforward	1.000	4.000	7.000	5.556	7.000	8.000	
	Polite	1.000	3.000	4.000	4.222	6.000	8.000	
	Effective	2.000	4.500	6.000	5.630	7.000	8.000	
	Enthusiastic	1.000	2.000	3.000	3.667	5.000	8.000	
	Playful	1.000	1.500	3.000	3.407	4.500	8.000	
	Adventurous	1.000	1.500	4.000	4.074	6.500	8.000	
T2: personality	Discreet	2.000	3.000	4.000	3.741	4.000	5.000	
	Caring	1.000	3.000	4.000	3.556	4.000	5.000	
	Easygoing	2.000	4.000	4.000	4.037	5.000	5.000	
	Cheerful	1.000	3.000	4.000	3.769	4.000	5.000	1
	Openminded	2.000	3.000	4.000	3.926	5.000	5.000	
	Honest	3.000	4.000	5.000	4.519	5.000	5.000	
	Creative	1.000	2.500	3.000	3.259	4.000	5.000	
	Intriguing	2.000	3.000	4.000	3.630	4.000	5.000	
	Down to earth	2.000	3.000	4.000	3.741	4.500	5.000	
	Respectful	3.000	3.000	4.000	3.926	4.500	5.000	
	Flexible	2.000	3.000	4.000	3.593	4.000	5.000	
	Direct	2.000	3.000	4.000	3.778	4.500	5.000	
	Committed	1.000	2.000	3.000	3.037	4.000	5.000	
	Reliable	2.000	3.000	4.000	3.667	4.500	5.000	
	Engaging	2.000	3.000	4.000	3.963	5.000	5.000	
	Proactive	1.000	3.000	4.000	3.630	4.500	5.000	
T3: features	Spontaneous	1.000	3.000	4.000	3.519	4.000	5.000	
	Join a group	1.000	3.000	3.000	3.192	4.000	5.000	1
	Relationship mode	1.000	3.000	3.000	3.259	4.000	5.000	
	Time is ticking	2.000	2.500	3.000	3.185	4.000	5.000	
	Gift voucher	1.000	1.500	2.000	2.074	2.500	4.000	
	Stay safe	1.000	3.000	4.000	3.630	5.000	5.000	
	Self-report	1.000	2.500	3.000	3.111	4.000	5.000	
	Chemistry	2.000	3.000	3.000	3.185	4.000	5.000	
	Match boost	1.000	2.000	2.000	2.556	4.000	5.000	
	Smart move	2.000	2.000	3.000	2.926	3.500	5.000	
	Flirting tips	2.000	2.500	3.000	3.037	3.500	5.000	
	Rate users	2.000	2.000	4.000	3.407	4.500	5.000	
	Common interests	1.000	4.000	4.000	4.000	5.000	5.000	

■ Highest priority ■ Lowest priority

Figure N.4: NCAD results for men designers

Appendix O

Design bias study: Wilcoxon results

Task	Design Elements	Test 1	Test 2	Test 3	Test 4
T1: feeling	Comfortable	0.6412	0.4187	0.06043	0.7061
	In control	0.815	0.9169	0.165	0.4518
	Engaged	0.7375	0.9689	0.9257	0.9734
	Safe	0.9348	0.02081	1	0.9067
	Confident	0.0736	0.5754	0.5732	0.1931
	Happy	0.1765	0.5227	0.85	0.1245
	Respected	0.529	0.4741	0.5795	0.9202
	Appreciated	0.9836	0.2299	0.4437	0.7873
T1: value	Empowerment	0.1468	0.5472	0.3535	0.02449
	Freedom	0.8629	0.1278	1	0.7254
	Privacy	0.8255	0.423	0.9252	0.8283
	Honesty	0.01605	0.1872	0.9203	0.02088
	Empathy	0.7514	0.5909	0.576	0.8004
	Reciprocity	0.475	0.926	0.7728	0.5418
	Self-awareness	0.6991	0.8144	0.164	0.1711
	Equality	0.5353	1	0.2256	0.6888
T1: communication	Calm	0.7525	0.4574	0.5751	0.6388
	Kind	0.3575	0.08554	0.8528	0.2659
	Straightforward	0.07176	0.8654	0.3569	0.1505
	Polite	0.338	0.4972	0.23	0.6617
	Effective	0.83	0.2371	0.3455	0.5435
	Enthusiastic	0.2859	0.7646	0.3993	0.09485
	Playful	0.1075	0.3341	0.01048	0.5797
	Adventurous	0.07687	1	0.1591	0.1123
T2: personality	Discreet	0.1818	1	0.8405	0.08302
	Caring	0.6739	0.955	0.3354	0.884
	Easygoing	0.02908	0.6733	0.04886	0.1376
	Cheerful	0.2523	0.5738	0.2947	0.8391
	Openminded	0.8994	0.9141	0.7761	0.8623
	Honest	0.8428	0.01442	0.4652	0.7294
	Creative	0.4592	0.1689	0.5049	0.4207
	Intriguing	0.5651	0.3218	0.7723	0.4774
	Down to earth	0.2822	0.7424	0.4426	0.6726
	Respectful	0.7161	0.7829	0.6864	0.958
	Flexible	0.399	0.4675	0.4379	0.6969
	Direct	0.2373	0.552	0.6251	0.4251
	Committed	0.3338	0.8717	1	0.3074
	Reliable	0.2751	0.4423	1	0.3864
	Engaging	0.2341	0.1959	1	0.2172
Proactive	0.9244	0.3177	0.5459	0.7427	
Spontaneous	0.2566	0.8409	0.8474	0.4573	
T3: features	Join a group	0.3636	0.5913	0.5695	0.7211
	Relationship mode	0.5549	0.4743	0.8496	0.3396
	Time is ticking	0.0119	0.1461	0.1932	0.05469
	Gift voucher	0.5092	0.6867	0.9148	0.4933
	Stay safe	0.6092	0.5126	0.432	0.7185
	Self-report	0.03171	0.5996	0.3467	0.1044
	Chemistry	0.6	0.8472	0.5607	0.8185
	Match boost	0.5204	0.1651	0.2075	0.3848
	Smart move	0.2969	0.4098	0.07237	0.9029
	Flirting tips	0.3635	0.978	0.1944	1
	Rate users	0.2626	0.1345	0.8443	0.54
	Common interests	0.8226	0.9454	0.8478	0.5373

Figure O.1: *P*-values for differences between design participants (NCAD) by participants' gender (test 1), by personas' perceived gender (test 2), by participants' gender for a persona perceived as a woman (test 3), and by participants' gender for a persona perceived as a man (test 4) using the Wilcoxon test.

Task	Design Elements	Test 1	Test 2	Test 3	Test 4
T1: feeling	Comfortable	0.4875	0.07459	0.8746	0.2706
	In control	0.4261	0.5448	0.9117	0.2528
	Engaged	0.6364	0.7462	0.1592	0.4286
	Safe	0.2265	0.3355	0.08837	0.8011
	Confident	0.9142	0.09552	0.436	0.747
	Happy	0.628	0.03371	0.7004	0.4385
	Respected	0.5109	0.5322	0.1574	0.7667
	Appreciated	0.4617	0.9795	1	0.2225
T1: value	Empowerment	0.09377	0.9206	0.343	0.1261
	Freedom	0.6295	0.07351	0.1934	0.5218
	Privacy	0.5569	0.03505	0.3019	0.9017
	Honesty	0.03153	0.3615	0.06893	0.3147
	Empathy	0.8357	0.0134	0.9109	0.712
	Reciprocity	0.7828	3.38e-05	0.4033	0.414
	Self-awareness	0.4031	0.6018	0.2763	1
	Equality	0.2901	0.002348	0.8557	0.5363
T1: communication	Calm	7.754e-05	0.0853	0.0463	0.000247
	Kind	0.7723	0.3851	0.8075	0.9214
	Straightforward	0.4512	0.596	0.2842	1
	Polite	0.7966	0.05573	0.8582	0.7286
	Effective	0.2144	0.9077	0.3532	0.4576
	Enthusiastic	0.2438	0.3595	0.7219	0.2716
	Playful	0.544	0.1141	0.5191	0.617
	Adventurous	0.4306	0.3314	0.9105	0.4881
T2: personality	Discreet	0.494	0.02653	0.6465	0.3164
	Caring	0.9227	0.005437	0.8787	0.6623
	Easygoing	0.7753	0.9926	0.7326	0.04463
	Cheerful	0.1619	0.6343	0.9593	0.18
	Openminded	0.4958	0.73	0.6493	0.05154
	Honest	0.04887	0.1632	0.3251	0.1656
	Creative	0.6576	0.7214	0.3716	0.116
	Intriguing	0.779	0.847	0.169	0.116
	Down to earth	0.1062	0.3295	0.8507	0.02189
	Respectful	0.2344	0.7237	0.1586	0.7581
	Flexible	0.8673	0.7523	1	0.8692
	Direct	0.938	0.5978	0.836	0.7737
	Committed	0.5112	0.2659	0.6128	0.1463
	Reliable	0.5147	0.2747	0.9227	0.3687
	Engaging	0.3907	0.4163	0.9599	0.2455
	Proactive	0.2668	0.3574	0.833	0.1513
Spontaneous	0.3557	0.4017	0.5047	0.5939	
T3: features	Join a group	0.501	0.3893	0.1214	0.4278
	Relationship mode	0.04427	0.3741	0.02033	0.5246
	Time is ticking	0.6707	0.6458	0.1426	0.4831
	Gift voucher	0.8961	0.2538	0.3179	0.4746
	Stay safe	0.6914	0.5082	0.2947	0.5758
	Self-report	0.224	0.9719	0.4148	0.4668
	Chemistry	0.2858	0.1953	0.346	0.7049
	Match boost	0.5524	0.2049	0.2523	0.6723
	Smart move	0.7756	0.3085	0.7008	0.8873
	Flirting tips	0.1938	0.8226	0.2905	0.4788
	Rate users	0.05037	0.05122	0.2025	0.2729
	Common interests	0.5703	0.0805	0.8324	0.7726

Figure O.2: *P*-values for differences between computer science (TCD) participants by participants' gender (test 1), by personas' perceived gender (test 2), by participants' gender for a persona perceived as a woman (test 3), and by participants' gender for a persona perceived as a man (test 4) using the Wilcoxon test.

Appendix P

The influence of persona's gender: informed consent

What do users need?

The aim of this survey is to understand how participants choose features for a specific user. You will have one task: to choose features for a general online dating app considering the user description that will be given to you. It will take less than 5 minutes to complete it. There are four different users and one will be randomly assigned to you.

If you agree to participate in this study and are comfortable with the information presented here, you may proceed to express your consent to participate in this research which is part of a PhD program within the School of Computer Science and Statistics at Trinity College Dublin. We are taking advantage of our personal relationships to recruit participants through online social media. That is, you have seen this directly or indirectly because of a relationship you have with one of the researchers. The research has only scientific purposes and is not funded or endorsed by any company.

If you consent, you will anonymously provide some information before taking the survey (gender, age and nationality). The survey is available in English and Brazilian Portuguese. It will take around 5 minutes to complete. This survey presents no risks. Your participation is voluntary, and you won't be paid for doing this. You can withdraw at any time before submitting your answer, without any prejudice. Once you submit your answer you cannot withdraw because the submission is anonymous, and we have no way to identify which response was provided by any particular individual.

The information collected will be used for scientific purposes. All the data can be retained for a period of 10 years after the last publication of any scientific findings referring to this research to comply with the Code of Good Research Practice of Trinity College Dublin. The results of this research are expected to be published in scientific conferences.

Results of the research will be available upon request. If you want to receive these results or have any doubts about the survey, contact the principal researcher emailing lopesm@tcd.ie.

By clicking the button below, you acknowledge that your participation in the study is voluntary, that you are 18 years old or older and competent to give consent, and that you are aware that you won't be paid, that the research doesn't represent any company and present no risks, that you may choose to terminate your participation in the study at any time before submitting your answers without penalty, that your participation is anonymous, that the data will be used for scientific purposes and published in a way it doesn't reveal your identity, that data can be kept up to 10 years after the last publication, and that you can email the researcher if you have doubts or want to discuss the study.

Statement of investigator's responsibility: I have provided participants with information on the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions by email. I believe that sufficient information has been given in order for the participant to understand the experiment and this freely give informed consent.

Milena Ribeiro Lopes - lopesm@tcd.ie

21st February, 2019

Appendix Q

The influence of persona's gender: boxplots of the distribution of data

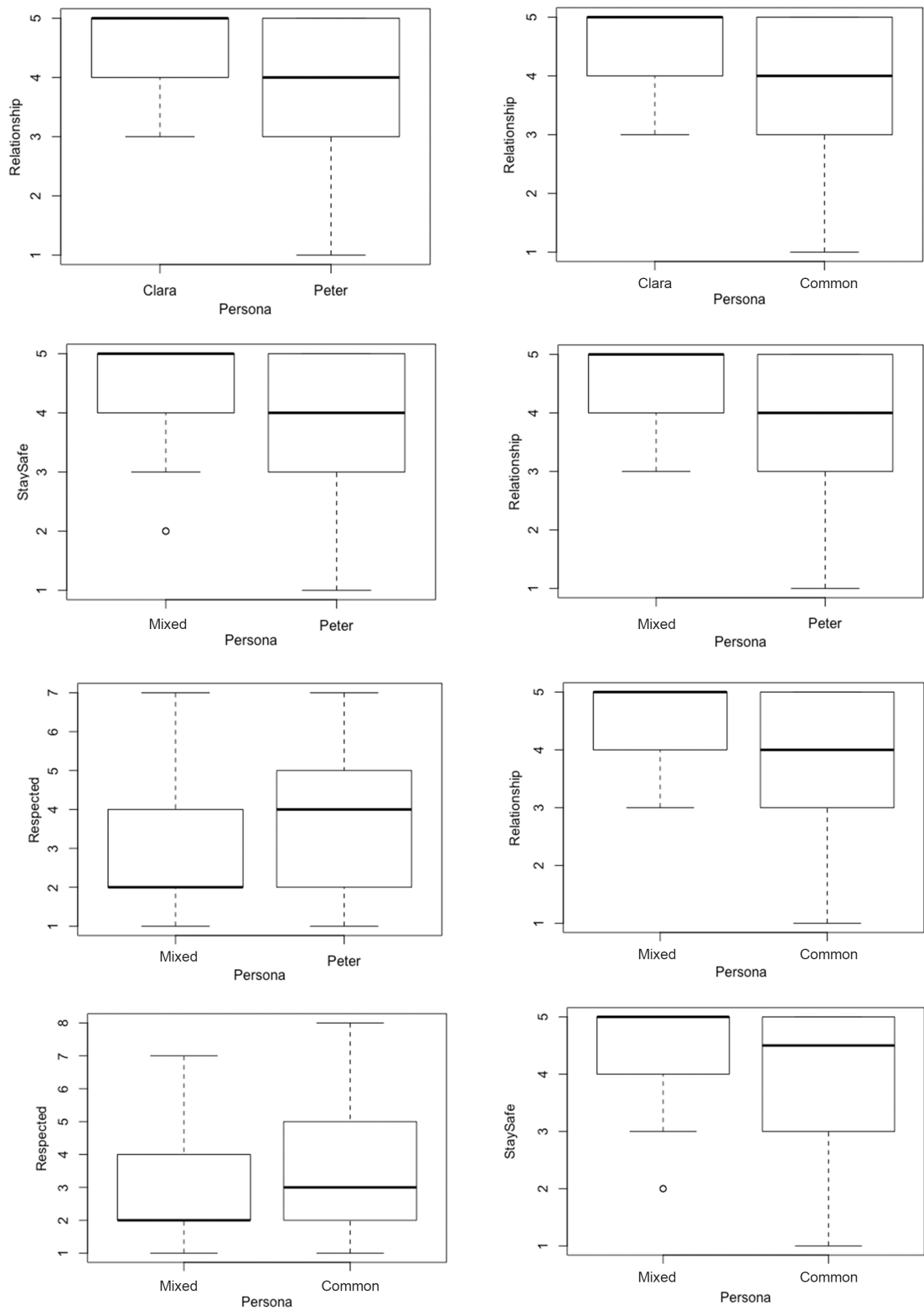
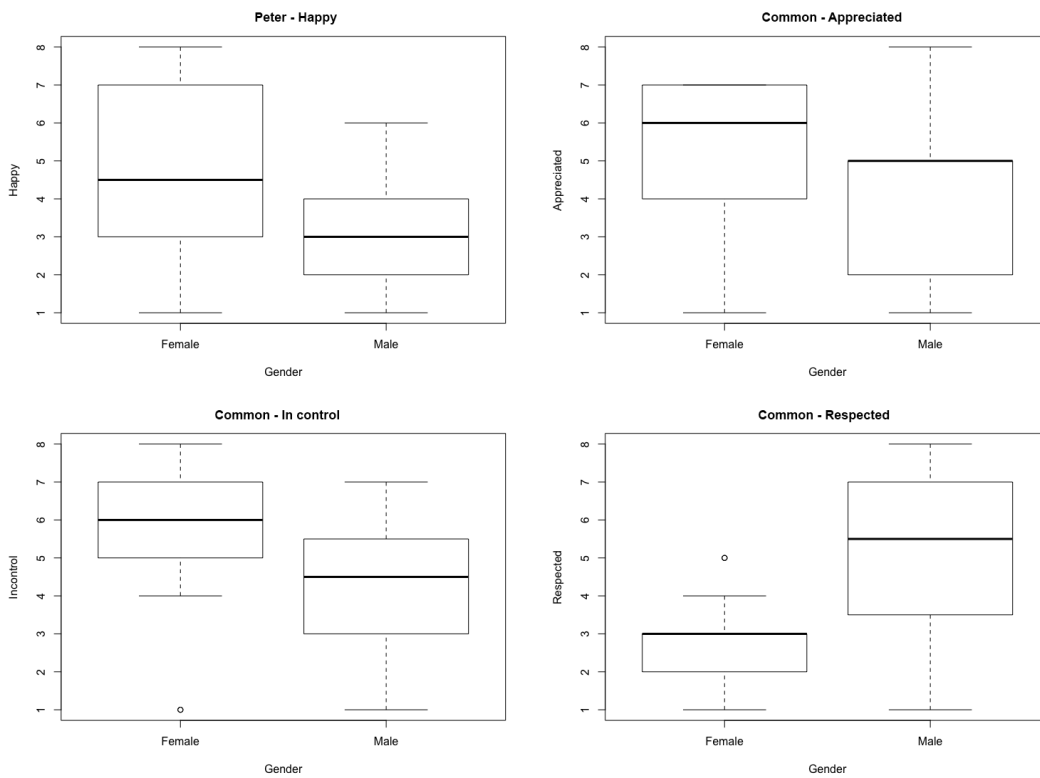


Figure Q.1: Plots of median values of elements with significant differences or approaching significance in priority setting for comparison between personas in tasks 1 and 2 according to personas' gender.

Task 1



Task 2

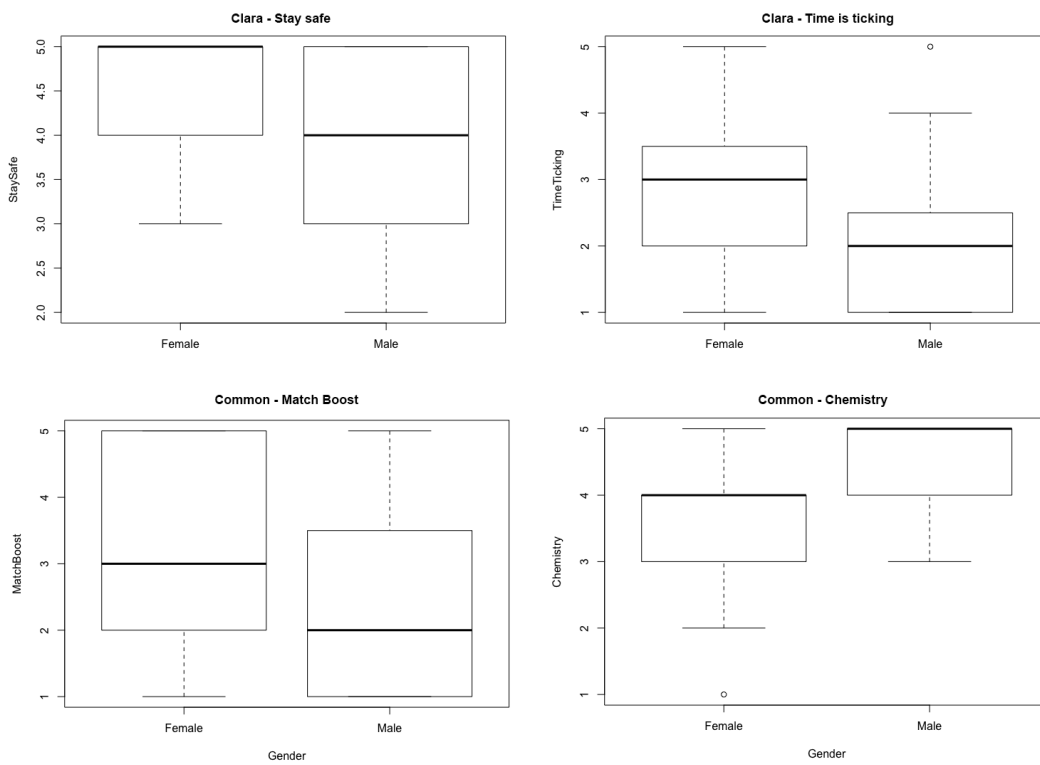


Figure Q.2: Plots of median values of elements with significant differences in priority setting for each person in tasks 1 and 2 according to participants' gender.

Appendix R

The influence of persona's gender:

Wilcoxon test results

		P-values for test 1: differences between personas					
Task	Design Elements	Male & Female	Male & Mixed	Male & Common	Female & Mixed	Female & Common	Mixed & Common
Task 1: feeling	Comfortable	0.6967	0.9458	0.1271	0.5941	0.2101	0.1152
	In control	0.7764	0.355	0.4229	0.6094	0.7722	0.8116
	Engaged	0.2778	0.5764	0.684	0.09242	0.5127	0.3047
	Safe	0.4499	0.8901	0.823	0.4876	0.5496	0.9679
	Confident	0.9402	0.571	0.8405	0.4452	0.7184	0.7397
	Happy	0.4895	0.0885	0.2174	0.2765	0.848	0.3578
	Respected	0.4076	0.0334	0.916	0.201	0.5501	0.0507
	Appreciated	0.126	0.7862	0.4322	0.115	0.4088	0.5055
Task 2: features	Common interests	0.2481	0.7606	0.6361	0.4131	0.4997	0.9081
	Join a group	0.4176	0.507	0.5142	0.927	0.88	0.9789
	Relationship mode	0.0246	0.0097	0.8725	0.7422	0.0421	0.01907
	Time is ticking	0.719	0.9167	0.0602	0.7724	0.1203	0.07681
	Gift voucher	0.9503	0.8932	0.1331	0.927	0.1795	0.1366
	Stay safe	0.0846	0.0078	0.7418	0.2956	0.2915	0.0528
	Self-awareness	0.3502	0.8691	0.9575	0.3195	0.2974	0.8764
	Chemistry	0.5896	0.5942	0.9113	0.9535	0.4175	0.4431
	Match boost	0.821	0.6773	0.843	0.863	0.9868	0.8447
	Smart move	0.4878	0.3455	0.6927	0.9455	0.7485	0.6803
	Flirting tips	0.5414	0.3847	0.6441	0.8437	0.3862	0.2503
	Rate users	0.286	0.2169	0.8771	0.8986	0.269	0.2161

Figure R.1: P-values for test 1: differences between personas using the Wilcoxon test.

P-values for test 2: differences between participants' gender					
Task	Design Elements	Clara	Peter	Mixed	Common
Task 1: feeling	Comfortable	0.9869	0.7724	0.309	0.4426
	In control	0.5822	0.7239	0.4084	0.01715
	Engaged	0.6096	0.7596	0.9293	0.7574
	Safe	0.6718	0.4495	0.7108	0.4115
	Confident	1	0.3888	0.6162	0.156
	Happy	0.8845	0.03914	0.4708	0.7192
	Respected	0.7713	0.5879	0.9891	0.001181
	Appreciated	0.612	0.4746	0.9029	0.0456
Task 2: features	Common interests	0.5599	0.7003	0.3408	0.2854
	Join a group	0.4027	0.2136	0.1691	0.7589
	Relationship mode	0.6733	0.9582	0.6672	0.9622
	Time is ticking	0.01788	0.4642	0.7089	0.8592
	Gift voucher	0.6659	0.2846	0.3448	0.2406
	Stay safe	0.01995	0.726	0.2091	0.7388
	Self-awareness	0.1607	0.8488	0.1431	0.4315
	Chemistry	0.1804	0.3391	0.3516	0.01012
	Match boost	0.961	0.05562	0.6218	0.04771
	Smart move	0.503	0.9039	0.6277	0.3806
	Flirting tips	0.452	0.427	0.621	0.462
	Rate users	0.8496	0.6022	0.4944	0.3377

Figure R.2: P-values for test 2: differences between women and men participants for each persona using the Wilcoxon test.

P-values for test 3: differences between inflections					
Task	Design Elements	Clara	Peter	Mixed	Common
Task 1: feeling	Comfortable	0.01336	0.2579	0.9682	0.7887
	In control	0.4693	0.02474	0.1447	0.2537
	Engaged	0.5061	0.5296	0.6518	0.892
	Safe	0.2708	0.5064	0.3403	0.09211
	Confident	0.4794	0.6465	0.4421	0.1938
	Happy	0.02908	0.03761	0.07448	0.2929
	Respected	0.712	0.5458	0.5023	0.3345
	Appreciated	0.276	0.5893	0.4265	0.003252
Task 2: features	Common interests	0.5624	0.5153	0.05611	0.1624
	Join a group	1	0.5387	0.2224	0.7732
	Relationship mode	0.3528	0.7782	0.4546	0.8026
	Time is ticking	0.4328	0.5603	0.2519	0.02424
	Gift voucher	0.3641	0.9275	0.6519	0.9493
	Stay safe	0.8756	0.6115	0.9628	0.5097
	Self-awareness	0.07124	0.9703	0.936	0.5201
	Chemistry	1	0.324	0.4711	0.8986
	Match boost	0.257	0.8915	0.9572	0.4459
	Smart move	0.7701	0.8043	0.5418	0.8694
	Flirting tips	0.7452	0.8959	0.9224	0.9517
	Rate users	0.1871	0.1535	0.6593	0.4747

Figure R.3: P-values for test 3: differences between 1st and 3rd person inflections for each persona using the Wilcoxon test.

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