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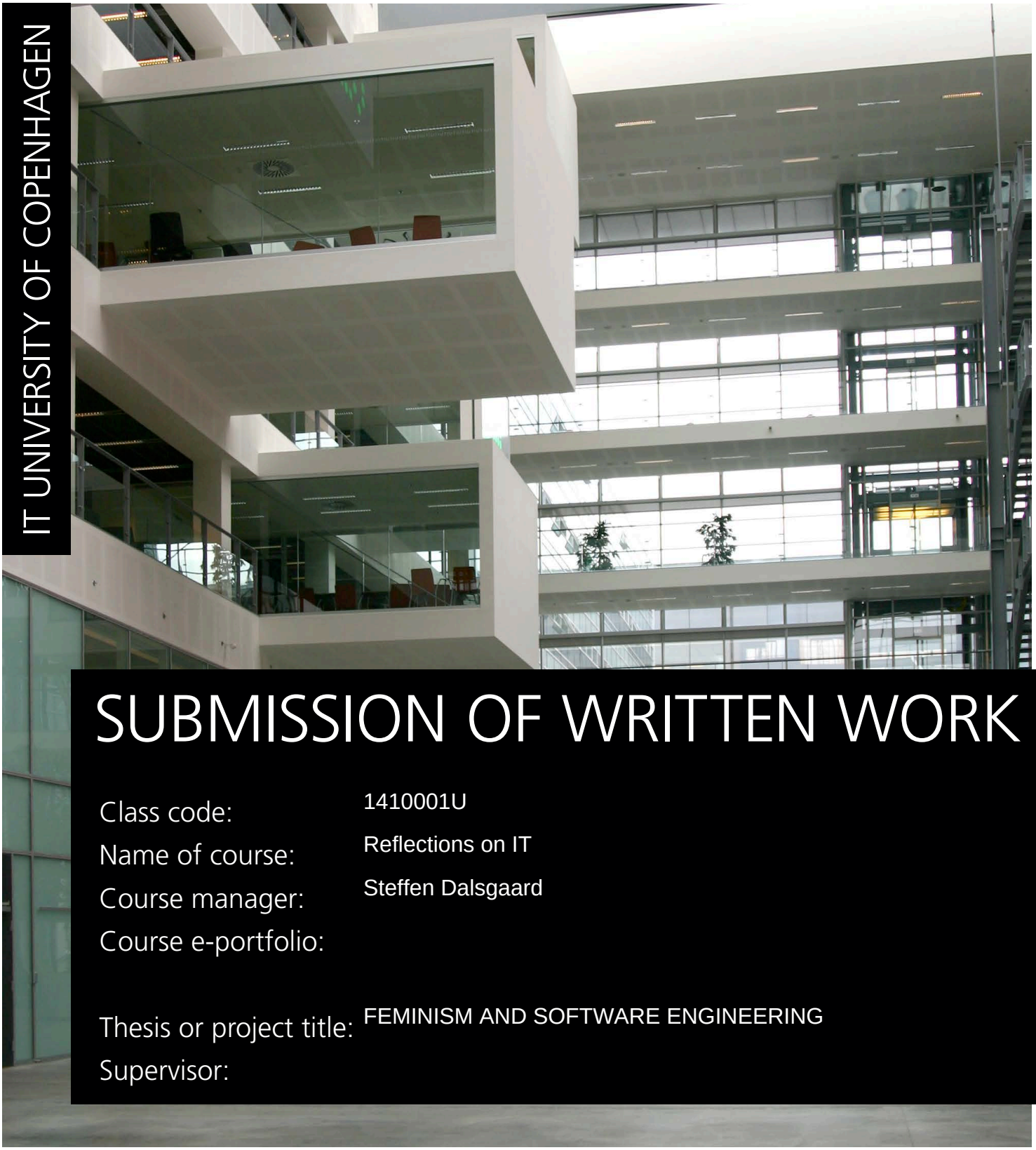

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FEMINISM AND SOFTWARE ENGINEERING

By Alma Rosager Freiesleben

Contents

1 Introduction

> *"I am a computer scientist, they know that. I am working at a university for computer scientists, they know that. I am teaching programming, they know that. I am actually producing research in computer science, they know that. It doesn't matter, they still ask me in the end of the day: "so, can you programme as well?, wauw okay, you don't look like a computer scientist"*
> - Natalie Schluter (2019)

Natalie Schluter is an Associate Professor and Head of the Data Science Programme at the IT University of Copenhagen (ITU). The above quote is from the program *21 Søndag* made by Danmarks Radio (the television program can be found here [3]). Although she is a leading figure within IT and especially at ITU, she does not "live up to" the existing stereotype, that is associated with being a computer scientist. The label that a computer scientist is a male with headphones sitting in his basement with an energy drink is most likely not a completely unfamiliar picture. Natalie clearly does not fit into that category by the fact that she is a woman.

In the same television program, it is said that the percentage of women students at the Software Engineering study programme at ITU has increased a lot over the past years. The reason for this increase could be the big effort that the university's communication department has done aiming the communication material towards female students. Initiatives such as Coding Camp for women, Coding Classes for women and the appearance of women in the communication material at the website and in the folders.

The IT field is booming [7] and it is almost harder to name a field not touched by IT, than to name a field where there is no IT. Since this is the case there are plenty of opportunities within the IT field and being part of the IT field is also being part of shaping society. Furthermore, the IT field has been associated with a discourse that is aimed at men and with direct prejudice towards women. This among other things have resulted in an industry that is dominated by an overweight of men.

1.1 Research Question

> *How does the discourse about the IT field, have an impact on the imbalance of gender in that field?*
>
> *Does the gender imbalance in technology influence the development of society?*

1.2 Definition of Key Terms

In order to prevent unmistakably misleading the reader, a clear definition of key terms is in place. The focus of this section is to clarify what is meant when the term 'software engineering' is used throughout the paper.

1.2.1 Software Engineering and Computer Science

Throughout this paper I will use the terms 'software engineering' and 'computer scientist'. The term 'software engineering' has two different mentions throughout the paper. It is used as a term that describes a profession and it is used as the name of the study programme at ITU under consideration. Throughout this paper computer scientist is also used as the name of a profession similar to the profession software engineer.

2 Theoretical Framework

When searching for answers to my research questions, I will look into Janet Abbate's research of the history of the 'birth' of software engineering. Furthermore, I will look into Marie Hicks' research of how Britain historically has discarded women technologists. This is done with the hope that their findings in regards to the women's changing participation in computing can describe tendencies in the IT field today and that they will illuminate the disadvantages of discarding women within the IT field.

2.1 Women's Changing Participation in Computing

Janet Abbate is an Associate Professor of science, technology, and society at Virginia Tech. In 2012, Abbate published the book *Recoding Gender: Women's Changing Participation in Computing*, where she traces the history of Computing, in particular she traces the field of software engineering. One of the main observations is that the 'birth' of software engineering was shaped by a set of very diverse concerns, namely: managerial concerns, the unfamiliarity of a programmers profession, and stereotypical assumptions about gender.

Abbate mentions Grace Hopper, who is considered the inventor of the first compiler and the first compiler based programming language, FLOW-MATIC, which laid the ground work for the development of the programming language COBOL (pp. 79 [4]). Grace Hopper was a leading figure in the IT field in the 50s. What defined the IT field back then was that being a programmer was a more independent practice, where the endeavour too was very individual (pp. 94-95 [1]). Abbate notes that Grace Hopper was a leading figure not only in the industry, but more particular in the U.S. Navy. *As a female software expert, Hopper occupied an ambiguous position. [...] she never fully adopted a management perspective, since women had no realistic hope of rising into the upper ranks of computer firms.* (pp. 82 [1]). Within those circles Abbate notes that Hopper would have no hope of rising into upper management, because only men were treated for such management positions in the 50s/60s.

In 1968, the NATO SCIENCE COMMITTEE sponsored a conference with the purpose of discussing the diverse concerns about the software production. Back then computers were a very complex machinery, this was not compatible with the existing view that programming was an individual process, furthermore it was not compatible with the fact that it was hard for managers to manage the expert programmers because of their unfamiliar work tasks. Around the same time the label *software crisis* was used to refer to the fact that a lot of hours were put into programming, but much of the output failed. Since computers were so complex it made people aware that developing larger software projects would require large groups, hence it would require both more communication and management, which was identified as troublesome (pp. 91-93 [1]).

At the NATO conference *software engineering* was coined as a term. There were a general discourse that programming was a tedious labour, that was preferably performed by machines (pp. 88 [1]).

The conference is famous for establishing a linkage of engineering as referring to programming and from here globalizing the term *software engineering*. What the conference is infamous for is for not inviting a single woman expert or leader to participate, such as Grace Hopper, who was a representative of a large employer of programmers, the U.S. Navy, at that time.

Abbate notes that from the 40s programming was a task dominated by it's prominent women. At that time before the term *computer* was applied to a machine, it was used as a profession predominantly performed by women [8]. *"Whether or not men were conscious of the gender connotations of engineering, women in the field were often all too aware of them. [...] programmers were accorded a lower status than engineers and that programming was seen as less skilled because women did it."* (pp. 103 [1]). Abbate highlights that one of the reasons that programming was perceived as a less skilled profession in contrast to engineering was because it was women who did it. Furthermore, those work task were devalued by the patriarchal culture of that time.

In short the establishment of the term *software engineering* brought with it a discourse with an undertone that implied gender discrimination, in the sense that is was implied that men were better suited for engineering professions.

> *"It was also a snobbism about being an engineer or not. [...] I remember arguing with people who [said] that 'Engineering was much harder, **much** harder, than what 'we women did'—than software.'"*
> - Judy Clapp (pp. 104 [1])

Abbate notes that this discourse might have brought some consequences in regards to gender equality within the IT field, because it lifted software engineers as being something masculine. One of the key takeaways from Abbate is that the prevalence of the idea, that men were better suited for positions in upper management, had some destructive results on how the whole industry took shape subsequent of the 50s/60s.

> *"[...] there was never a single, coherent meaning for the term software engineering. Individual programmers, managers, and computer scientists adopted the term to serve a number of diverse and potentially conflicting agendas. But one group was conspicuous by its absence—female software pioneers."* (pp. 102 [1])

Abbate notices that programming has been dominated by women in the 40s, but has become visibly male dominated since then, this is some kind of shift in the profession i regards to gender. As Abbate states in the quote above *"one group was conspicuous by its absence-female software pioneers"*.

2.2 The Impact of Discarding Women From the IT Field

> *"Stephanie Shirley's company only succeeded once she began signing her letters "Steve""* (pp. 236 [1])

The above quote is from the book *Programmed Inequality - How Britain Discarded Women Technologists and Lost its Edge in Computing* by Marie Hicks (see pp. 236 [2]). Marie Hicks is an Assistant Professor of History at the Illinois Institute of Technology. Marie Hicks mentions Stephanie Shirley in her book. Shirley worked with creating job opportunities for women programmers and still she had to use the male alias 'Steve' in order to have her company succeed. Shirley identified and benefited from the labour shortage at that time, by offering flexible hours to the women, this enabled her to *"tap into a deep pool of skilled women programmers"* (pp. 229 [2]).

Hicks touches the same theme as Abbate, namely how men were treated as better suited for management positions, this she relates to historic events in Britain and how the women labour was not recognized nor valued in an attempt to put men into the programming position although they were less technically skilled in comparison to the women at that time. Furthermore, she pines how this among other factors were destructive for the whole IT field.

Throughout the history, Britain has been in need of labour in the IT field in the years after World War II. Through the years the women who in the 40s/50s had a predominant role in the IT field was not identified as a labour force that could solve the demand for labour at that time. First around the 70s the Civil Service began to hire women that had left the industry to focus on family. Hicks states that although this was a positive move, it only came as a result of the shortage of labour (pp. 229 [2]).

In 1978, a major Institute of Manpower study begun. It was identified that because of the increasing demand of computers, it was hard accommodating the labour shortage, the researchers in the project focused on what parts of the population that could fill this hole. *"They did this without paying attention to gender, however, instead focusing exclusively on divisions of class in what they assumed to be exclusively male workforce."(pp. 229 [2]).* Hicks finds this ironic because of the unidentified group of women, who had dominated the tech field in the past, before the field was dominated by men.

Hicks identifies how historically there has been a persistence in perceiving women as less technically competent. Furthermore, Hicks refers to a report made by Teresa Rees, a British Social Scientist, in 1992. This report touches, in particular, Britain but also the whole European society culturally has constructed roles for both men and women. She finds that these roles has brought with them a lack of acknowledgement for the technical skill and the technical achievements of women (pp. 231 [2]).

Another women tech expert that Hicks mentions is Andrina Wood, who in 1958 were assigned the job as to demonstrate a new computer in Australia. Wood had programmed the thing, but despite that and despite her being an expert, according to Hicks, she would not have been describes as a computer expert at the time (pp. 231-232 [2]).

One of the key takeaways from Hicks historical study is that she maps events through British history that has excluded or devalued women in the IT field.

> *"Before they disappeared they defined the shape of computing, and after they disappeared their absence continued to shape the field."* (pp. 233 [2].

In the above quote, Hicks refers to the fact that the women disappeared from the IT field, and their absence has an impact on the field. Hicks mentions Eden Medina, who in a study stated the following: *"The state and its priorities shape how technology is designed and used."* (pp. 234 [2]) Hicks follows this claim by arguing that technology when at best can help marginalized groups, but also do the opposite by further marginalizing groups.

> *"The low proportion of women CEOs in high-technology fields and elsewhere is not a new issue, or coincident: It is the legacy of structural discrimination and the persistent devaluation of women's abilities."* (pp. 236 [2].

The part of title of Hicks book is "How Britain Discarded Women Technologists and Lost Its Edge in Computing" this implies that through the British history events have had the effect that women were discarded and that this had a serious impact on how the industry took shape afterwards.

3 Analytical Discussion

The following section analyses and discusses how the historic discourse about the IT field and the discarding of women have had an impact in today's discourse and society. *Section 3.1* analyses and discusses the discourse about the IT Field by investigating the findings by Abbate and Hicks as well as investigating how in transfers to the discourse today. *Section 3.1.1* is a small case study of the communication material at ITU. Lastly, *Section 3.2* analyses and discusses the impact the discarding of women within the IT field have had on society.

3.1 Discourse About the IT Field

Having a discourse that raises men over women and directly stamps women as being less qualified for something is the sort of discourse that ensures unhealthy powers, in this case of gender inequality, to remain.

Abbate and Hicks reports that throughout the history both the discourse within the IT field and a direct disposal of women within the IT field have had a major impact of women's participation within the field.

Abbate argues that within the IT field a shift from a profession being dominated by women in the 40s, to become a profession dominated by men happend after the NATO conference. At this conference, where the term *software engineering* was established, there was a general discourse that programming was a tedious labour.

The establishing of the term *software engineering* was shaped by some diverse concerns, one of them was the stereotypical assumption about gender, namely that women were not suitet for engineering professions, and they were less technically skilled than men. You could argue that this has had its manifestation all the way up to today. *"[...], they still ask me in the end of the day: "so, can you programme as well?, wauw okay, you don't look like a computer scientist"* [3]. This is a clear implication, that there is a clear idea of how a computer scientist looks like, it is funny that it is something that lies in a persons look, probably safe to say that it lies within the gender, when it comes to the profession computer scientist. Furthermore, there is an astonishment in this quote that a woman can programme as well. This is a clear example of when the stereotype, that a computer scientist is a man is expressed and this is an example of what retains the gender imbalance today.

3.1.1 ITU's communication material

The study programme Software Engineering at ITU is still visibly male dominated. But over the past years the share of women students have increased from 11% in 2016 to 17% in 2018 [5]. Initiatives aimed only at women could be an important factor in this increasement. Looking at the communication material,

in particular the pictures used by ITU, it is clear to see how its agenda is to break with the stereotypical computer scientist (see Appendix A).

Both pictures have a very bright light and both shows a motif of both female and male students. In the first picture all four students are in focus and in the second picture it is the female student who is in focus. The first picture is related to a campaign at the university, that encourage potential applicants to write and ask students about things in regards to the study programmes. Both the use of light, the focus on people instead of machines and the diverse gendered group in the pictures is a break with the stereotypical assumption, that a computer scientist is a male sitting in a basement programming. It is a break with the discourse that has been shaped since the shift from a profession being dominated by women, to a profession dominated by men.

Using the communication channels to undermine the stereotype, by showing alternative role models, might encourage a more diverse group of peoples interest. Especially having women role models, that potential women applicants can mirror themselves in. As Abbate states, it has been forgotten, that women have had a dominant role within the IT field (pp. 109 [1]), therefore it is important to actively show that women are just as capable as men.

It is interesting to reflect on the name of the study programme, namely Software Engineering, since this is the exact same term that Abbate finds to be a provocative and masculine term, back when it was established, but she also finds that the connotation of the term has changed, *"The term software engineering has become common enough today that its provocative effect has been lost."* (pp. 98 [1]). Today comparing the study programme Software Engineering at ITU with the study programme Computer Science at The University of Aalborg, the share of female students is almost double at ITU, Software Engineering [5]. This implies that the connotation of the term *software engineering* might have changed to become less connected to masculinity.

3.2 The Impact of the Discourse in the Development of Society

One of the key points from Hicks book is historically what impact, especially negative impact, the systematic discarding of women technologists have had for Britain. Because women were not identified, nor acknowledged for their technical skill, the labour shortage within the IT field continued for many years. Furthermore, since men were preferred over women, more qualified labour was discarded and less skilled men were put into the technical professions.

Looking at the NATO conference it consisted of only men, this contributed to the stereotypical assumptions about gender. Being only men, although at that time the IT field was dominated by women, excluded the women to have a say in the matter of redefining the IT field. Today we have a situation where

women have been discarded for so many decades, therefore the field are heavily dominated by men.

Chimamanda Ngozi Adiche held a speech at the TEDxEuston, this talk was later published as a book "We Should All Be Feminist" [6]. The talk, is Chimamanda's unique definition of feminism in the 21st Century. *"A feminist is a man or a woman who says, "Yes, there's a problem with gender as it is today, and we must fix it. We must do better.""*, here Adiche stresses that in order to change the problem with gender, both men and women have to participate.

Since the IT field is booming today and there is a grave demand for labour within that field it is important that the discarding of women within this industry does not continue to further retain the gender imbalance within the IT field. Abbate explains how the establishment of the term *software engineering* and the connotation of the term has had an impact on the shift from the IT field being dominated by women in the 40s, to an industry dominated by men up until today. Since the industry has been dominated by men for so long, it is hard to break with habits and traditions, which could explain why the stereotype of a computer scientist is male. It will be hard to undermine and it requires both men and women to agree that there is a problem with the gender imbalance.

> *"If technology is only developed for one part of the population, then it is really that part of the population which is profiting the most, which is getting the most benefit from the technology. If you have women simply who aren't participating in that, they are not participating I shaping society in this way"*
> - Natalie Schluter (2019) [3]

The quote above is essential in regards to what impact the discarding of women within the IT field have. Because the IT field has been dominated by men through the past decades, the IT field has been shaped by men. Natalie stresses the point that, because the IT field is booming and the IT field shapes society, it is of highest importance that women get a role in this, because if not the women won't be a part of shaping society, which would cause even greater gender imbalance and maintain the stereotypical perception of women not being capable with technology, what both Abbate and Hicks through historical facts, shows is not the case.

4 Conclusion

With the use of Janet Abbate's trace of the history of the field software engineering and Marie Hicks study of how Britain turned away from women labour in an attempt to put men into the positions of programming especially in positions of management, it is possible to conclude, that the discourse that came with establishing the term *software engineering* at the NATO conference in 1968 had a huge impact on how the IT field evolved afterwards. Because the term *software engineering* had a masculine connotation, furthermore because engineering professions at that time were preferably possessed by men and lastly because womens technical skill were not acknowledged, even experts within the field such as Grace Hopper were not invited to the NATO conference in 1968, because of that the IT field experienced a shift from being dominated by women, to be dominated by men.

Because of these historical events a stereotype of a computer scientist has been formed. The stereotype first and foremost is a man. The IT field today bears the mark of this stereotype and it is visible in the number of women at technological study programmes, such as Software Engineering at ITU. Although there has been an increase of women at ITU, Professor Natalie Schluter still gets remarks with an undertone of surprise that she is able to programme and that she does not look like a programmer.

This stereotype has to be undermined, and that can take a long time, since it has been developed over decades. Undermining such embedded perceptions take time. As stated by Chimamanda Ngozi Adichie, *"A feminist is a man or a woman who says, "Yes, there's a problem with gender as it is today, and we must fix it. We must do better.""* [6]. Because the gender imbalance in technology has a grave impact on society, this is of significant importance and as Adiche states, "We", it is we who need to do better, both men and women. At the ITU, the communication material is an example of an action taken to counteract this stereotype, by establishing role models that breaks with the stereotype, in their pictures.

With the use of Marie Hicks historical study, it is possible to conclude that the gender imbalance in technology influence the development of society. In Britain the continuing labour shortage was e.g. caused by a systematic exclusion of women and acknowledgement of women's technological skill, this has caused the loss of progress within the IT field. Furthermore, less skilled men were put into the technical professions, which affects the quality of the solutions. If women are not engaged into the IT field again, this tendency can keep on, not only in Britain but in the whole world, since the demand for labour within the IT field increases. Furthermore, as Natalie notes, if women are not part of the development of such a dominant force that has a great impact on society, then women are excluded of having an influence of the development of society, which would maintain the gender imbalance.

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5 Appendix

5.1 Appendix A: Pictures from ITU's Software Engineering Website