

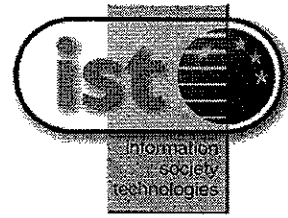
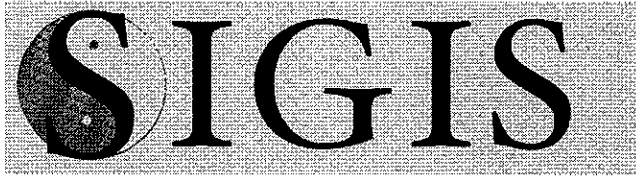
Vivian A. Lagesen

Computer Science - Careers or Computing?
Inclusion through "secularization" of ICT

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Computer Science – Careers or Computing? Inclusion through “secularization” of ICT

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**SIGIS: Strategies of Inclusion: Gender in the
Information Society**

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1. Introduction: The anatomy of the inclusion strategy in the Women and computing initiative

The Women and computing initiative at NTNU has been a quite large, successful and rather broad-spectred inclusion initiative, aimed at getting more women to study computer science. As reported in the case study of the initiative (Berg 2002), the initiative allowed a quite rich and interesting analysis of the inclusion strategy as well as the underlying assumptions about gender and ICT. This report documented that the initiative consisted of a range of different actions. The resulting inclusion strategy was thus broad, and it included activities directed at recruitment as well as at socialisation, the latter in order to integrate women into computer science as a discipline and as a profession. Recruitment initiatives covered three main dimensions: Information/ invitation, "seduction" and allocation of particular quotas of admittance for female applicants. Socialisation activities included curricular reform, study quality reform and reform for increased student satisfaction.

The inclusion strategy of the initiative arguably achieved a substantial rise in the number of female students. Thus, it was regarded as a great success. However, the initiative could be viewed as theoretically and politically questionable, since it tended to naturalise and dichotomise gender in quite strict terms. This was shown through an analysis of the advertising campaigns that was made by the initiative. Thus, there were several good reasons to do a user case study of the initiative. What kind of effects did it have, and how did students react to the messages about gender and computer science?

Our research questions included, first, to what extent did female computer science students notice the initiative before they applied? And if so, did it have an impact on their choice of study and if so, in what way? Second, are there particular aspects of the broad inclusion strategy that are perceived as more important and /or effective than others? Third, how do the students react to the dualistic messages about gender and ICT in the advertising campaigns? Fourth, how is the initiative perceived by female students that could have chosen computer science, but did not? And among female students who chose a programme where computer science was combined with linguistics?

Regarding the Women and computing initiative, we observed in the companion case study (Berg 2002) that there were three types of instruments used in recruitment: Giving information about the study programme, inviting, convincing or seducing potentially able women to apply and to allocate quotas for them. Similarly, the socialisation part in this case was seen as consisting of reforming the curriculum, offer technical facilities and make sure the social environment is satisfactory for the students.

If we try to place the concrete activities in this conceptual scheme, they may be placed like shown in figure 1, which summarises the anatomy of the inclusion strategy as a whole (taken from Berg 2002). Using this as an analytical backdrop for the analysis of inclusion strategies in the Women and

Computing initiative, we can make an “anatomical figure” of the inclusion strategy used in the initiative.

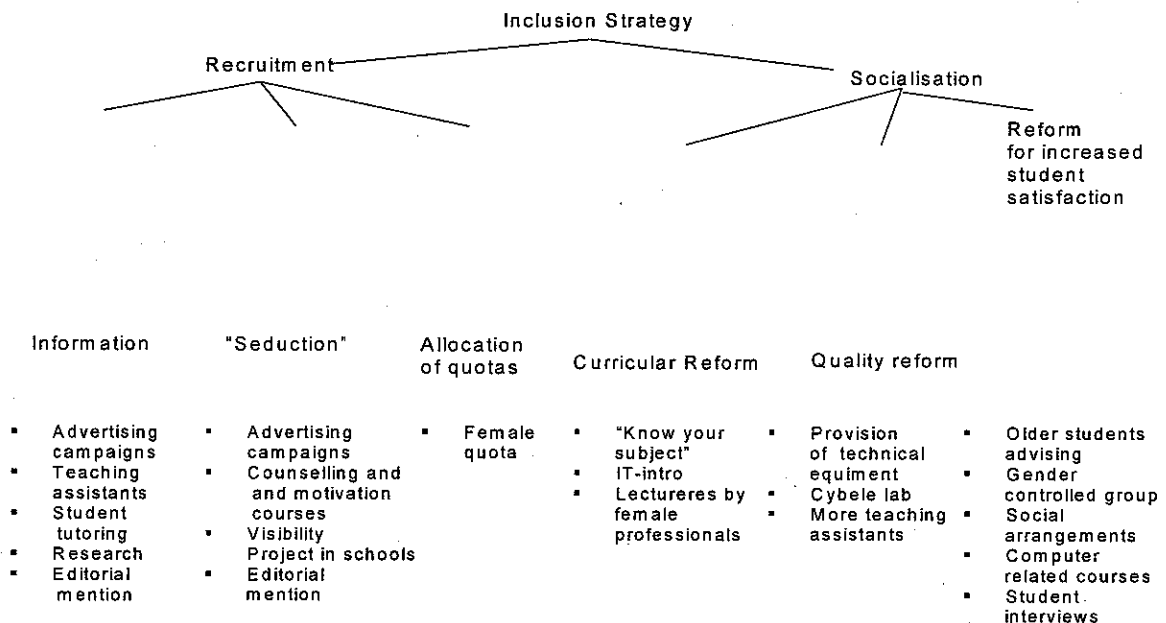


Figure 1. The anatomy of the inclusion strategies of the initiative (from Berg 2002).

Figure 1 represents an overview of the main features of the inclusion strategy that was developed and implemented in the Women and Computing initiative. We see clearly how this initiative combined several inclusion activities, related to recruitment as well as socialisation. In particular, the recruitment efforts were quite extensive and radical. Our previous analysis of the Women and Computing initiative uncovered problematic ideas about gender as well as computer science in the campaign material. Above all, we found a clear tendency to naturalise gender, in particular the female gender. This was especially well illustrated through the advertising campaigns that were analysed in the companion case study report (Berg 2002, see Lagesen 2003 for a more detailed analysis). The three campaigns tried to redefine the gendering of computer science through a strategy playing on traditional gender dichotomies as well as related engineering dualisms. Women were described as skilled with people, user-oriented and pragmatic, which fitted neatly with the proposed image of computer science as primarily about working with people, communicating and finding no-nonsense solutions. Men were depicted as nerds, mainly interested in technical aspects and thus less suitable. This may be illustrated by figure 2, which is one of the images from the campaign called ‘Squares and Circles’. The caption reads: “Girls make circles. Boys make

squares. The universities want more computer science students who make circles”.



Figure 2. Girls make circles. Boys make squares (from Berg 2002).

Clearly, in terms of recruiting more women in computer science, it looked as though this effort of redefining the gendering of computer science was a success. The redefinition is a way of positioning women in the ICT discourse as carriers of competence really needed by the industry. Thus, it creates space for women in the computer science profession as particularly useful people. It might also serve as an argument to legitimise their presence within the profession, without having to use the equal opportunity argument alone. So, in this sense it might be viewed as a highly politically correct project to focus upon assumed traditional femininity as an important and valuable characteristic for being a good computer professional.

However, there are important problems in the dualistic co-constructions of gender and ICT (Lagesen 2003). The gender dualisms tend to recreate notions of the masculine as the norm and the universal and the feminine as the other and the negation. From this point of view, it is risky to pursue the kind of strategy developed by the Women and computing initiative because it may in the end just reinforce the traditional gender hierarchy. In addition, the use of dualisms invites thinking in terms of stereotypes. We observed in the Women and Computing initiative, particularly in the advertising campaign, frequent

references to quite stereotypical perceptions of femininity and masculinity. However, we do not know whether the students are affected by the dualistic thinking and the stereotypes. Thus, this calls for empirical investigation.

2. The user issue in the study of inclusion strategies

What does it mean to do a user study of an inclusion effort like NTNU's Women and Computing initiative? Let us briefly consider a similar initiative at the Carnegie Mellon University, analysed thoroughly by Margolis & Fisher (2002) who highlights a wide spectrum of efforts to get more women to study computer science at one of the leading US universities in the field of computer science. Arguably, in terms of numbers, this was a very successful inclusion effort. Carnegie Mellon succeeded in increasing the percentage of women entering the School of Computer Science from 7 % in 1995 to 42 % in 2000. In the same period, they managed to reduce the dropout rate for women very considerably, to reach about the same low level as for men (less than 10%). The main ideas put into action included (Margolis and Fisher 2000:130-34):

- *Reducing the impact of the experience gap of men and women.* Boys usually have more experience than girls in the use of computers before they begin to study, but the amount of prior experience is not a good predictor of eventual success as a student. Through curricular change, the School provided four different ways to enter the curriculum, depending to the student's level of prior experience.
- *Admissions policy* was changed so that admissions criteria did not give a strong preference to highly experienced students.
- *More attention to good teaching*, since failures in pedagogy or in curricular integration turned out to affect women disproportionately.
- *Contextualising computer science* was deemed important since female students particularly found real world uses appealing.
- *Efforts to change the hacker-ish culture* of the School were made, but they were not deemed very successful.
- *Outreach to high schools* in order to make teachers more conscious about the way they impacted their female pupils' relationship towards computers and how they could motivate girls to apply to study computer science.

Carnegie Mellon's inclusion efforts are interesting also because the efforts to recruit and keep more female computer science students were based on a broad and careful analysis of the exclusion mechanisms previously at work. All the main actions mentioned above are of this character, and they relate to an image of computer science as a culture perceived as rather hostile by most women.

It is important to note that the success criteria used by Margolis and Fisher in their account of the Carnegie Mellon experience is not just the obvious quantitative measures of the proportion of women enrolled and the comparison of dropout rates. They also consider how the female students

experience the study of computer science, the impact on the culture of computer science and even how the outreach towards high school teachers impacted their views on gender and computing.

From a more general point of view, we could – with Aune et al. (2002) – identify two set of challenges related to the problem of studying what users do with technologies, programmes, inclusion efforts, etc. The first set is related to the vagueness of the concept of the user. This should serve as a reminder to be sensitive to the possibility of great variety and the need to differentiate between various categories of users and even of non-users. In this case study, we clearly have several user groups, where the following three could be considered the most prominent:

- The women who actually are studying computer science/computer engineering at NTNU – the narrow target group of the initiative
- All women who could potentially have chosen to study computer science at NTNU – the broad target group of the initiative
- Employees and male students at Department of computer and information science at NTNU, who could be considered an implicit target group for the set of actions aiming to reform the study culture of computer science.

In this report, our main focus remains upon the first two groups. We have not analysed the points of view of employees nor male students.

The second set of challenges related to analysing how users interact with technologies or sets of actions is based on the identification of five different version of the “problem of the users” from the perspective of the designer (Aune et al. 2002):

- *The attractiveness problem:* have we been able to provide solutions that are sufficiently attractive to sufficiently many users through knowledge of what they want or need?
- *The identification problem:* have we been able to find the relevant group of users (or the market segment), through knowledge about differences among potential users in terms of needs?
- *The problem of the non-users:* why may people resist, reject or be without access to a technology, or in our case, the Women and computing initiative?
- *The problem of instruction or control:* Have we been able to provide designs or actions that make users act in a relevant manner, utilising options of shaping affordances?
- *The usability problem:* Have we been able to design user-friendly artefacts or actions by making them understandable and in line with users’ mental models?

These challenges will serve as a backdrop for our analysis, which also will draw explicitly on the domestication model (Sørensen et al. 2000). The domestication model emphasise that artefacts or action programmes, like the Women and computing initiative, need to be integrated in the setting of the

users in order to succeed. This integration means practical and well as symbolic appropriation, and it may even be necessary to consider the cognitive aspect of how use is learnt.

It may be easier to understand the domestication of an artefact than of a set of inclusion efforts like the Women and Computing initiative. What could we mean by considering inclusion efforts as something to be 'used'? In terms of recruitment, there are obviously two very critical user issues. The first is related to the ability to create a positive image of the computer science and engineering programme at NTNU to young women, so that they will decide to apply and, eventually, to become enrolled. In order to have an effect, the campaign must have been noticed by the women. Did they actually see the campaign, and did it have an impact on their choice of study? And if so, what arguments made an impact? The second is related to the motivation of the women to become computer science students and their understanding of computer science. What features of computer science and the way it was presented in the campaign resonated with the women's motives? We know that the Women and Computing initiative promoted a dualistic image of computer science, proposing that women were particularly suited to work with what was put forward as the most important part of computer science in practice – working with people. How did the women interpret and encounter this message?

In terms of socialisation efforts, we could ask if the efforts were appropriated to the extent that they are made use of and/or considered in a positive way? However, it may be as fruitful to approach this problem by looking more generally at the way the female computer science students appropriate their study programme and the way they experience the culture at the Department. This is due to the fact that there were many inclusions efforts made with basically the same goal, namely to create a more woman-friendly study culture and curriculum. To analyse the efforts individually might in fact be difficult, since – presumably – it is the totality of measures that are important, not the individual action.

3. Method

The analysis is based on qualitative interviews with both users and non-users of the initiative. The users of the initiative are here defined as women who applied and started at the computer science/engineering programme at NTNU. This is a 5-year computer science/engineer programme, which lead to the protected title "sivilingeniør" (master of technology), which is a highly regarded and prestigious title in Norway. Traditionally, it has also been a springboard to managerial positions. The four categories of people interviewed were:

- Ten female students in their 4th or 5th year in the computer science and engineering programme

- Five women who applied to the computer science and engineering programme at NTNU and were admitted, but did not accept the offer.
- Seven female students who have chosen different, but related types of education.
- Four were students at the Energy and Environment engineering programme at NTNU (Energy and Environment). Also this a programme leads to the “sivilingeniør” title.
- Three were students at a computer science programme at NTNU called “Informatics, Language and Culture”. This is a one year interdisciplinary program that combines subjects from the Faculty of Humanities (linguistics and applied linguistics) with computer science.
- Two young men and nine women who attended a computer party, and thus could be considered computer enthusiasts (‘The Gathering’, see Nordli 2003). These interviews were conducted together with Hege Nordli. Four group interviews were performed. Interview 1 was with three young women, aged 16, 17 and 19 respectively. Interview 2 was with two young women aged 16 and 17. Interview 3 was with two young women, both 21 years of age. The fourth and final group had two young men and two young women. The men were aged 16 and 17, while both the women were 16 years of age.

Some of the interviews were conducted in groups and some individually. The interviews with those who declined the offer to begin to study at the programme were performed via e-mail, where the informants wrote answers to open-ended questions.

We did not have the possibility to control the selection of informants, so we cannot claim that our sample is strategic nor accidental. This means that some care has to be exercised when drawing inferences from the study. Consequently, we have in our analysis been looking for differences between the informants in order to identify different reactions to the Women and Computing initiative as well as to computer science as an education and the overarching issue of gender and ICT. However, some general patterns emerged across a quite diverse set of informants, and we believe these to have a more general validity.

The design of this case study puts a lot of emphasis on potential users and non-users. This means that it is the recruitment aspect of the Women and computing initiative that is the main focus. We believe this choice is justified also from the fact that the recruitment aspect was the most original part of the initiative. Compared to the socialisation efforts at Carnegie-Mellon described earlier (Margolis and Fisher 2002), this part of the Women and computing initiative appears as less well developed.

A focus on recruitment means that the motivation to choose computer science or other study programmes becomes an important issue. The design of

this case study allows us to compare female computer science students in terms of motives with the other four above-mentioned groups.

This comparison allows us to look into several interesting aspects. In our analysis of the Women and computing initiative, this campaign appears to be instrumentally oriented in its arguments, highlighting career options and future pay levels. Moreover, it downplays computer science and the use of computers as potentially fun and engaging. Instead, it emphasises the non-technical aspects of working with computers. This made us wonder whether the computer science students at NTNU would be motivated instrumentally rather than by an enthusiasm for their study topic? Would perhaps the adolescent computer enthusiast at the Gathering display a greater passion towards computers? The influx of female students at the Energy and Environment programme came without any great recruitment efforts. What motivated these women? The comparison with students from the Informatics, Language and Culture course allows us to check whether a humanistic context would make the relationship to computer science different. Finally, the fourth group allows us to check why some women at a late stage decides not to study computer science after all. Had they come to see computer science as less attractive, or was their decision more influenced by factors not related to the topic of their study?

4. Experiences of being recruited: Perceptions of female applicants

In this section, we will analyse the two groups of women that applied to study computer science and engineering at NTNU, those who actually entered and those who eventually declined the offer. The group that actually started this computer science education were female students in their 4th and 5th year. This means that at least four years had passed since they decided to enter, which means that it has been a long time since they encountered the recruitment campaign. However, they would have a lot of experience of being computer science students, which we will utilise in our analysis of the socialisation efforts in section 8.

The rejectors had applied to enter the programme about half a year before the interviews took place. Thus, they are probably better informants related to the recruitments initiatives and their strengths and weaknesses.

4.1 Women who entered the programme

The efforts of the Women and computing initiative to recruit women included the introduction of a quota for women, advertising campaigns and an information activity called 'Women's Day'. A common feature in these inclusion initiatives was the effort to make women feel wanted. The advertising campaigns also implied an effort to redefine what computer science was partly by emphasising the idea that computer science was rather

about communication and working with people, partly by highlighting the good career prospects. We know that the initiative was considered successful because the number of female students increased quite dramatically. However, our informants told rather different stories about their choice to study computer science/engineering and their perception of the inclusion initiatives. In the following, we will present some of their stories and arguments.

As noted previously, the recruitment campaign – in particular the advertisements – put a lot of emphasis in providing an image of computer science as something that was not so technical, but rather a field of study that focussed on people and required good people skills. Thus, we could assume that at least some of the women would be motivated by this, and that their alternative education option would have been non-technical.

However, this was not the case. Catherine's account is in many ways typical of the women who applied to and started at the programme. She did this, she said, first of all to become a graduate engineer. She figured she wanted that after she had studied mathematics for one year at the University of Oslo. Then, she found out that she preferred an education where teaching was more structured. Also, she wanted to study in a new town, where she did not have many friends before. If she moved to Trondheim, she thought it would be easier to take part in and enjoy student activities. Her main preference was to study something where mathematics and physics was important. An engineering programme at NTNU seemed a good choice, given the status and prestige of this education. She had not really thought of computer science. However, when she saw the Women and Computing campaign, and since she had always done some computing, she thought "why not?" She had also considered starting on the marine technology programme, but she is very glad she did not. She said she found computer science more interesting.

In fact, Catherine's account of her motives and her way of reasoning around her choice contain many elements that are typical for most of our informants in this group. They are interested in science and mathematics, they are motivated by future career options, and they have some but not a strong interest in computers. Their way into computer science is through a more general interest in "some kind of" engineering programme, as were told by Christine. She had decided very early, around the age of twelve that she wanted to do a master of technology programme at NTNU. Many in her family had a master's degree in engineering, and she said she came very slowly to the conclusion that she wanted to do the same. Computer science and engineering was a suitable study because she had always liked mathematics, and she knew it was a lot of mathematics and physics in this programme. She also knew that people who had taken this education had "pretty decent jobs", as she put it. Christine also had a mother that was a teacher, which she perceived as a job alternative not so tempting, in comparison to the engineers she knew. At the outset, she had wanted to study industrial economics or mathematics/physics, but her class in high school had been asked to evaluate the advertising

campaign made by the Women and computing project and they had discussed it in class. In this way, she became aware of the possibility to study computer science.

Camilla told a similar story. She first and foremost wanted to become a master of technology. She did not know about the campaign before she applied, but she was convinced during the "Women's Day" that she wanted to begin. She also said that she did not consider whether it was many women in the programme when she chose it. However, now she is very happy that they were many women in her class, because she saw that the class of the previous year only had 5-6 women, and she thinks it must be more difficult to find someone to get along with. In that sense, she thinks it has been good that it has been more women.

The importance of a general interest in science and mathematics is also evident from Celina's account. She was not as sure as the two others that she wanted to become a master of engineering. She had been thinking more about studying mathematics and physics as well as French. She went to France and started to study mathematics and physics in an engineering programme there. But she did not like the way the programme was organised; it was too much of an "infant school", she said. So, she went back home, and then by accident she chose computer science. She had not seen the campaign, since she was in France at the time, but a female friend of her had started, and she recommended it to Celina. Celina had never done any computing before and never had a machine at home. But her friend had told her that this did not matter at all. It went well anyway.

However, Celina got no support at home for her choice. Her parents told her: "You want to start studying computer science, and you never touched a computer before??" Then I was really determined to do it, she said laughingly. Celina had also considered medicine, because it sounded as an exciting study, but she found out that she probably did not want to work as a doctor. Celina participated at the "Women's Day" and became very positive about the Women and Computing initiative and the study programme. She discovered there that several of the other women did not have any experience with computers before. Now she is very happy with her choice:

"The last couple of years I have become more certain that this is what I like, plus that you don't necessarily have to sit and program all day in a job".

Clara is doing her fifth year in Computer Science. She was very uncertain on what she would do and become. Like Catherine and Christine, her main reason to choose the programme was that this was an engineering education, with quite good prospects for getting a job. Her choice was, she said, "rather based on that I wanted to see what this study programme was like, rather than I knew that this was what I wanted to do and had decided beforehand". She did not take notice of the campaigns before she started. She had also considered

many other studies, like physiotherapy, the University of Agriculture and medicine. Clara had some computer subjects in high school, but not much.

Clearly, all these women have to some extent been influenced by the Women and computing initiative, but the impact is mainly to make them choose computer science rather than some other science or engineering education. Caroline's story is in a way typical. She told us that she started at the programme because of the Women and computing campaign. She was quite sure that she wanted to become a master of technology, but did not know which programme to choose. Then she saw the Circles and Squares brochure, where it said: female qualities, we want women, big words like that. So, she swallowed the bait, as she said. Also Christel wanted to become a master of technology. She had originally put mathematics and physics as her first priority. But she changed her mind and then she read about the quota and saw an opportunity to be admitted in computer science. So, she gave computer science a higher priority and was admitted.

Most of our informants give us the impression that in their choice of computer science, they are more motivated by a general interest in science, mathematics or engineering than in computer science as such. However, there were some exceptions. Charlotte too said she started at the programme because she wanted a higher engineering education and because she was interested in science subjects. However, she also told that she has a stepfather who is a master of technology in computer science, and she thought what he worked with sounded very exciting. Also, she was interested in computing, she said. Thus, she decided to apply for computer science and engineering programme. She could not remember what she had thought about the quota at the time she was about to choose study. She thinks she knew about the initiative, or perhaps she just heard that they were trying to recruit many women. But it was not vital for her whether there were many women in the programme.

Connie also emphasised an interest in computer science. At the outset, she studied physics and mathematics at the University of Oslo. Then, accidentally, she took a course in programming, which she enjoyed very much. From that experience, she decided to enter the computer science and engineering programme at NTNU. .

As we see, there is also divergence in what significance these women have given to the fact that there were many women in the computer science and engineering programme, which were one of the main messages in the advertisements. Some was positive, some quite indifferent and Carina was actually negative. She did not know about the quota or the initiative at all. She had spent two years in Austria before she started at the programme. When she found out about the initiative she was quite negative towards it:

"I was actually a bit negative, because of my prior experiences ... I was used to being in a class with very many boys, and that suited me very well. The women I had met until then were not a very good match for me. So, I was actually ... thinking, like: what's this?? (Laughing). But the

women I have met here were very different from the ones I met before. So, it was a very positive experience compared to what I expected."

To summarise, the recruitment campaigns seem to have had a quite substantial impact on these women's choices, but mainly by making them choose computer science rather than some other science or engineering degree. This is evident from the fact that many of the women started out with the wish to become a master of technology, mainly because of the prestigious title, and in turn, the good job opportunities combined with an interest in science subjects, which they wanted to pursue. The campaign does not appear to have succeeded in recruiting women who were not already interested in science and engineering; at least, there are no women in this category among our informants.

Thus, above all, the success of the Women and Computing initiative was in the way that it influenced the choice between different engineering programmes at NTNU or a science education. It made our informants aware of the computer science and engineering programme and attracted them also by inviting women in particular to this programme. They reacted positively to the message that computer science had good career prospects, but also that it signalled that this was a programme for women. Even if not everyone of them did recall to have seen the actual brochures, it seem that most of them indirectly have been in touch with the campaign, either through hearing about from friends like Celina who was recruited by a female friend (who used one of the campaigns important messages to convince her, namely that she did not need any previous knowledge). Also, the coverage in the media was quite substantial and most likely quite important for the recruitment (Berg and Kvaløy 1998). Thus, the recruitment part of the initiative seems to have been effective.

However, we should note that none of the informants remembered being attracted by the effort of to redefine the gendered meaning of computer science, arguably a major part of the advertisements. Their main interpretation of the campaign was as an invitation or a reminder that it could be a good idea also for women to study computer science. In fact, one might argue that the effort of redefining computer science as a concern for people rather than technology does not speak well to the motivation of the interviewed women, with the exception of Caroline, who said she was attracted by the campaigns message about women being good communicators and so forth. However, most of them were interested in science or engineering. Their alternative topics of study were in the same domain. Thus, the radical message about computer science as particularly suited for women does not really seem to have been appropriated.

4.2 Female applicants who turned down the offer

A main reason to interview some of the women who had applied to the NTNU programme and been accepted, but then declined the offer, was to

examine the reasons behind this change of mind and if this was related to any aspect of the inclusion strategy. Therefore, these female students were asked why they applied in the first place. Also, we asked if they had noticed the campaigns and if so, what did they think of them?. Further, we enquired whether the campaigns had influenced their choice to apply to the programme, and why they had changed their mind. We expected this group to be different from those who actually began their computer science education by being less interested in the topic and maybe also more critical about it. However, this was not the case.

In fact, several of them, like Therese, applied to the computer science and engineering programme because they thought it was a bit exciting to use computers. As Therese saw it, the programme also gave a broad competence that opened many possibilities. She also liked science subjects a lot. She had been using computers a lot previously, not only surfing the internet, but also doing a bit of hardware tinkering and the like. Therese said that she had been the one amongst her female friends who used to have the greatest interest in technology, computing, sound and light: "Many thought of me as suitable for computing. And I did enjoy it myself too". She had received a brochure ("Winning?") from her teacher in mathematics. First, she said that she did not remember much of it, only that it was pink, and that the lettering was white. Then she also recalled that the brochure presented women that studied or had completed the programme (computer science or communication technology) and how happy they were with the programme and Trondheim as a student town. She also recalled that it contained a brief presentation of the differences between the two programmes and job opportunities.

The argument in the brochure that had made the greatest impression on her was the focus on the many career opportunities. Also, she thought it would be boring to do the same kind of work all the time. If there was a great demand for her competence, she could perhaps change jobs easier, she thought.. In addition, the opportunity to study and work abroad made an impact on her choice, along with "the opportunity to work with different people, help different companies and get task that would help her to develop her skills and her personality".

When questioned whether or not she thought the brochures was fitted to make women interested in the programme, Therese responded that maybe the arguments about high salaries, a lot of travelling and a high status profession would appeal just as much to women as to men. But she thought it was a bad advertising that said that women gain knowledge by reading, while men gain knowledge by trying and experimenting, because as she said: "It is definitely the latter that tempts those who like computers and technical things as such!" This may be interpreted as a critique of the commercial for its way of stereotyping women and misrepresenting computer science, and the way it was directed at women who do not like to fiddle with computers, while the ones who do, learn that this is a masculine interest.

Therese was really interested in computing and considered herself to be a computer person. So, why did she not start when she was admitted? She told us that she chose not to start because, as she said, she was not sure whether this was what she really wanted to do. She did not want to rush into anything, and she wanted a year to think things through and maybe apply next year if she wanted to do so then. In the meantime, she has taken a job in a tele-company to work with computer people, as she put it, in order to find out if this is the right choice. Also Tina applied because computer science seemed interesting and was something she might like to work with later. She had received most of the information about the programme through her sister who studies cybernetics at a different department at the same faculty. She had also read promotional material from NTNU. She could not recall much from the brochure about computer science, but she remembered the pictures well.

The messages she got from it was that computing appeared to be an interesting subject, and that it seemed that the students at the programme enjoyed both the subject and the class very much. She said that it contributed positively to her decision to apply. In general, Tina was very positive toward the Women and Computing campaign and said she liked the brochure very much. She thought it described the subject as exciting for boys as well as girls. The fact that there is a lot of focus upon women makes it of course easier for them to dare studying such a subject, she added. She thought the brochure would get women interested because it informs about a computer lab for women, about the "Women's Day", and about the fact that there are many women in the programme. However, Tina decided to decline the offer. The main reason was that she had been uncertain whether she would study law or computer science. After attending the 'Women's Day', she found that the computer science and engineering programme was not as exciting as she had thought. She perceived it too much like high school, with its structured courses. So, she chose to study law instead, which is a study programme with more individual freedom.

Like Therese and Tina, Trude thought computer science might be an interesting topic. She had considered many different study programmes when she applied, like medicine, other engineering programmes at NTNU, to do a master in computer science, to become a dentist, a physiotherapist, etc. However, for a long time, she said she had a little dream about being a woman and study computer science. She thought it sounded fun, and at the same time, it would mean great job opportunities, being a woman with a computer science education. "A master of engineering degree in computer science will be highly appreciated in industry", she said. Trude had read about the programme on the Internet and in the brochures from NTNU. She remembers that it was a lot of stuff about the "Women and Computing" initiative. Trondheim stands out because there is actually a great deal of women in the computer science programme, she noted. When questioned whether as to she was influenced by the brochures, she said that the student scene did seem tempting the way it was described in the brochures, and the fact that so much was done to make women

apply. "It is more attractive to apply as a woman, when you know that you won't be the only woman there". Also, good job opportunities were an important argument, she thought.

Trude remembered that the brochures contained a picture of a girl she knows, who is in her fourth year of computer science. She reckoned that it had been a deliberate use of pictures of women in the programme. Apart from that, she cannot remember any particular attempts to make women interested. But the paragraph about Women and Computing is probably very important for the recruitment of women, she said. That there is such a paragraph probably makes more women "dare" to apply. Because then they know that there will be other women in the programme and that "you won't end up as the only woman among a bunch of boys that knows a lot of computing from before", she said. Trude used computers a lot and thought they are a great resource. Computers are very practical in most situations, and she thought Internet is a "genius idea!"

However, she ended up in giving first priority to a programme in electronic publication and multimedia technique, at a regional college in her hometown Gjøvik. This is a three-years computer engineering study, followed by two years with different graphical and computer technical courses. The main reason for this choice was that her boyfriend lived in Gjøvik. Nevertheless, she was very tempted by the good student scene in Trondheim, and would in a different situation rather have been there. Also because the master of engineering status is so highly valued by the industry.

The story of Tove has a different touch. She applied in order to have something ok to study if she was not admitted to architecture, which was her primary choice. She put equal weight on all subsidiary educations that she applied to. She did not see any information about the computer science and engineering programme until after she had applied. Tove said she did not remember the content of the campaign material that well, but she believed there was a lot about that men and women are thinking differently, and that the advert did help more women to apply to get admitted to the programme. Tove considered the promotional material as having an "okay layout" but there was nothing that was "super special" about it. Also, the brochure was very vague about how the study programme worked.

While Tove told us that she enjoys using computers, because they are helpful in many situations, she nevertheless did not accept the offer. At that time, she was still awaiting answers from universities abroad to which she also had applied. Besides, she had thought that the programme was something else than what she learned at the "Women's Day". Computer science was just something of temporary interest for her, and she learned that it was no use just doing it for one year. She thought that computers these days are so common that everybody need to know basics of computing. A full-fledged computer science education, however, would be too long, with too much programming and design of computers, she said. Tove also assumed that many of the

students at the programme would be rather asocial. Many are "hooked" on computing, she claimed, and you would also see a great deal of "tomboys" there. In the end, Tove entered a programme in marketing and business economy at the Trade Academy. Here, she also learned some computing, which she found very interesting. However, she did not regret that she did not enter the computer science programme, because she was very happy with the marketing programme.

The last woman, Tyra, applied for two reasons: First, she did not have enough credit points to be admitted to the Norwegian School of Economics and Business Administration (NHH). Second, she wanted to study in Trondheim, partly because one of her best friends did, and partly because of Trondheim's good student scene. Since she did not like physics or chemistry, many of the engineering programmes were dismissed. One day her math teacher came with brochures about the computer science programme and recommended the girls to have a closer look at this possibility. Because it said that you did not need any previous knowledge, Tyra thought it sounded okay, especially since it was directed at women. It was actually quite accidental, she said. It did influence her choice of study. The argument that no previous knowledge was needed, was felt as particularly comforting.

She found the campaigns to be okay, but very trivial. Tyra was a bit critical because what she noticed was that there were very many women that came forth and recommended the programme. In a way, it seemed like a piece of cake, because everything looked very easy. But the campaign did not bring forward what you really learn during the programme, she said. Thus, Tyra was ambivalent about whether the advertisements were suitable to make more women interested in the programme. Since she did apply, it must have effected her positively, she said, but what she felt when she faced the final choice, was that she had no idea about what she was heading towards. She went on the Internet and read descriptions of courses, and there was a lot there she did not understand. Many technical terms are of no use for people who only have used the computer for writing, downloading music and surfing on the Internet.

There were many reasons why Tyra did not accept the study place. First, people close to her were negative toward this choice, because they thought she would not make it. Second, many engineering students fail their mathematics courses, and she personally thought that she would not be able to do it. She had a B in mathematics in high school, but then her father was there to help her. Her mathematics teacher told her that she might make it if she became part of an effective working group, otherwise he would not say anything for sure about her chances to get by in this programme. Tyra said she also became quite negative when she heard about people who struggled so much with mathematics in the first year, considering that there are many years of mathematics after that. Third, she was admitted at the Norwegian School of Management (BI), and then she had an alternative.

She did not regret her choice of studying business; she told us she was happy with it, but also that she was a bit disappointed about herself because she seemed always to choose what appears to be the easiest way out. However, her parents as well as her friends thought she did the right thing. Her father had told her that she might have been able to drag herself through the programme, but she would never have become one of the best, and she do not like to be in the lower stratum among the students. She says it might be that she will learn some computer science after getting her business administration degree, but she doubt that she will ever do any in-depth study of computer science. Tyra believes that computer science studies is mainly for those who are very interested in computing and "live" in front of the screen seven days a week.

What made it attractive to her was the fact that it was a male dominated profession with possibilities for high wage employment. She never wanted a typical women's occupation where it is common with low wages. To summarise, it seems clear that also these women had in various degrees been in touch with the campaign. Mainly, they had seen the "Winning?" brochure. The campaign had in some cases influenced them to apply to the programme. However, the inclusion strategy was not able to persuade them to actually enter. Two of them who had attended the Women's Day, even declined the offer to enter because of the information they received there. Statistics says that 88% of the participants at the Women's Day decide to enter the computer science and engineering programme, so in general, this is a very effective inclusion initiative.

When we look at the choices of the decliners, we see that there are complex reasons behind their decisions not to enter the computer science and engineering programme after all. Some, like Tyra, are afraid that it is difficult. However, it is mathematics that they fear, not computer science. Most of the decliners are attracted by the good career opportunities, but computer science is not the only education with this feature. From this perspective, it is interesting to note that the alternatives chosen include law and business administration. And some, like Trude, are affected by personal relationships, which makes them want to study at a different place than Trondheim and probably also underachieving in their choice of level of study (see Henwood 1998). None of the main reasons given to decline the offer to enter the computer science programme have clearly negative implications for the programme or the Women and Computing initiative, perhaps with the exception of Tina's comment that she found the programme too structured and Tyra's who criticised the brochure for being too vague and containing too little information.

4.3 To enter or not to enter?

When we compare the two groups of women, those who entered the programme and those who declined, we find some clear similarities. First,

nearly all of them are very concerned about job prospects and career opportunities. Second, they are moderately positive towards computer science, but none appear to have been really enthusiastic. On the other hand, none of the women appear to be intimidated by the subject either, even if some found it comforting to be told that they were not required to know anything about computers before entering the programme. Third, nearly all of them seemed to appreciate being told that there would be quite a lot of women that studied computer science.

The main difference between the two groups appears to be that the women who entered, were more certain that they wanted an education in science or engineering. In fact, it is tempting to conclude that the main reason why young women choose to study computer science is a combination of an interest for and aptitude in science with an appreciation of the status of the education and its good career prospects. Their choice is above all sensible; it is the inclusion measures that speak to their rational approach to education that are effective.

This is clear from their reactions to the inclusion efforts. Most of the informants, those who entered as well as those who declined, were quite positive about the campaigns of the Women and Computing initiative. They particularly emphasised that they appreciated the message in the advertisement about job and career opportunities. A few though, were critical about the lack of factual information in the brochures, like Tyra, who actually chose not to start because she knew too little about the content of the programme and could not find sufficient information neither in the promotional material nor at NTNU's homepage. Therese also disapproved of the way in which the brochure described women's way of learning computer as based on reading in contrast to men's way of learning by fiddling with the computer, since she liked the latter. Apart from this, it does not seem that any of them had taken notice of the dualistic message or given it any weight. Instead, they were taken in by the information about good job opportunities and that there were many women in the programme. Thus, like the group of women who entered the programme, the decliners read the campaign selectively and in a quite instrumental way. None of them gave any impression that the information they have been given triggered a more expressive relationship to computer science; they report nothing that made them interested in the subject itself. These young women are rational and reasonable/moderate students.

5. Women who chose differently

The group of women who had applied to enter the computer science and engineering programme but declined in the end, we consider to be positive towards computer science. However, we were interested to explore if the perception of the programme and the way it was advertised would be more negative among young women who either chose to study something different or chose a computer science education embedded in a different study culture.

5.1 Engineering programme in Energy and Environment

The main reason for choosing to study this programme as a comparison with computer science was that it experienced an influx of women when it was initiated, but without any pronounced efforts. This made it interesting to see if the female students in Energy and Environment had a different motivation for entering a programme with a non-gender differentiated inclusion strategy.

The Energy and Environment programme was established in 1998. It was the result of a collaboration between two traditional engineering faculties at NTNU, the Faculty of electrical power and electronics and the Faculty of Mechanical Engineering. It was established for two main reasons.¹ First, that these two faculties saw a need for a more holistic way of dealing with certain problems related to energy and environmental issues than they could provide separately. Second, both faculties struggled with the recruitment to their programmes (especially the study programme of electrical power; this was actually phased out and replaced by the new programme). The two faculties thought they had an image as being sturdy, and judging from the number of applicants to their programmes, they did not appeal to young people anymore. The number of female applicants was especially low.

The new programme called Energy and Environment got a great influx of students and, as previously mentioned, the percentage of women increased to between 30 and 40 %. This is as high rate of women as the computer science programme accomplished through the Women and Computing initiative. However, Energy and Environment did not attempt to recruit women in particular. Their strategy were directed towards young people in general, though with a slight expectation that the name would appear more tempting to women than the former name of electrical power and machines. According to one of the spokespersons for the programme, the advertising material focused on presenting this programme “professionally, saying that this is a technical programme with an important contribution to the well-being of society”.

We interviewed four female students in the Energy and Environment programme. All of them were in their fourth year of the programme and was thus among the first to take this education. We asked them why they chose this education. We also inquired if they had noticed the Women and Computing initiative, what they thought about it, and how they regarded the computer science and engineering programme in relation to their own motives and interests. In addition, we asked them if they thought there were differences between computer science students and students in their own programme. We also showed them the promotional material from the Women and Computing initiative in order to learn how they perceived it.

To begin with, we expected that the women students at the Energy and Environment programme would share with the students of computer science a

¹ The information in this section is based on an interview with Anne Rossvoll, one of the administrative officers at the Faculty of Mechanical Engineering and programme administrator of Energy and Environment.

motivation fuelled by an interest in science and engineering as well as the appreciation of the status and career possibility of the education. To some extent, this was confirmed but with important modification. If we begin with Elisabeth, she told us that she had always been interested in science subjects, but there was really no study programme that attracted her. She started to study economics in another town, mainly to explore the topic. But while she was there, the Energy and Environment programme was established. She got to hear about it, thought it sounded very interesting and applied. It was her father that sent her some promotional material, but she also heard about the programme via friends who had seen a television advertisement. . She also went on the Internet and found out more about it. What made it attractive to her was her interest in the issue of energy crises, she said.

I did of course want something that I was interested in, something I thought was fun and something I thought I would enjoy doing. It is of course difficult to judge beforehand, because you never now how things turn out. But I also think it is a little important that there is a chance to get a job within the field after completing the programme. I would have found it very demotivating to study something and don't get to work with it later on.

As we see here, Elisabeth put a lot of emphasis on her interest and engagement in the study subject. Even if job opportunities were important for too, they were clearly not her main motivation for entering this programme.

Similarly, Emma told that she had always been interested in science subjects. Also, she had been an environmentalist ever since she was a little girl. She was always the one who ran after her playmates and told them not to throw paper and stuff on the ground, she said. Emma had wanted to work with science subjects and environmental issues and was so happy when this programme was established. Initially, she had considered studying environmental physics at the Agricultural University of Norway, but when this programme came she changed her mind about it and chose this programme.

When asked how they consider the computer science programme, Emma immediately said "Women and Computing" and laughed. She said she knew that women have "their own computer lab, where they are allowed to ask silly questions". She has read that in the paper. When asked whether they ever considered studying computer science, they were quite clear:

Elisabeth: No, never.

Emma: Never.

Vivian: Why not?

Elisabeth: It's just not my thing. I don't really know a lot about what the computer science programme is about, but I imagine it is a much programming, very much programming, and that ...

Emma: I know one I have been in the same choir with, and who is in the programme, and she is terrified now ... she is in her last year ... and just: "Oh, they will put me in a room and I have to sit there and programme" (laughter). (...) She really dreads that. But now she works

on a thesis where she does a little design on the net. (...) I think it is a lot of programming.

Elisabeth: It is a lot of opportunities there too, it might be that we are a bit narrow-minded about it: what is computing, what does a computer engineer do, like that. It was never an option for me. It was never an alternative.

Emma: But at the same time we have had some programming subject now, and I actually think it has been a bit cool (laughing). But at the same time, it was probably because we got just a little taste of it, and when it works, it is fun. It's a small kick: Oh, something is happening! Right? But I don't think it's something I would have wanted to do the rest of my life.

Vivian: So, if you think it is fun, if you got to choose again, would you have considered it?

Emma: No, absolutely not.

(...)

Vivian: But the image of the nerd, is that a reason for not choosing computer science?

Elisabeth: No.

Vivian: You haven't thought about that?

Emma: I'm not sure ... It (the nerd image, VL) is in the unconscious, I guess, I don't know. Before I applied to the Energy and Environment programme, it was in a way in the unconscious. Computer science was really out of the question. It was. It was really not a question. It was Energy and Environment or Environment and Constructions (laughing). But I guess that is because of the interest.

This sequence shows that the main reasons for them not to apply to the computer science programme was their lack of interest, or more precisely their positive interest in another field. However, they also formulated scepticism toward computer science because they believed it is mostly about programming, which is obviously perceived as a boring activity. Even so, they are aware that these views probably are based on prejudice and that they actually do not know that much about what computer science is. Also, Emma expresses a slight fascination for programming, having experienced that it was actually quite nice to make it work, but at the same time emphasising that she would not like to do it "the rest of her life". Nevertheless, the main observation is that, compared to the women who chose the computer science programme, there is a striking difference regarding motivation for the subject itself. Elisabeth and Emma chose out of an interest for the study subject and less because of job and career opportunities.

The Women and Computing initiative they mostly associated with the quota and the debate about it. They were not entirely against or in favour of it. They thought it was a positive thing because the atmosphere gets better with a more equal distribution of men and women in the class. The negative part was about the stigma on women, that they would get easier access than the men, and also that it seemed unfair toward boys.

When we showed them the Circles and Squares leaflet, Elisabeth barely remembered it, and only the front page. She had never seen the inside of it. Emma did not remember to have seen it at all. They had a look at it and both thought the front page was appealing. Elisabeth found it appealing because "circles are much cosier than squares" she said, laughing. Emma added: "It's a bit cute". They were both positive toward the message about women making circles:

Elisabeth: Yes, and then it doesn't say like: We are desperate, we need more women! It's more like: we need people who think differently than the ones who are already there.

Emma: It is kind of success stories though, for others who are ...

Elisabeth: Very cute babes who have done well in the programme.

Emma: For women who are uncertain on what they want to apply to, it might seem appealing, and then they would have had people applying.

Elisabeth: But I don't think it would have got me interested in computing. If I already had thought about it, it might have had appealed to me. But it would not have got me interested in the first place.

Emma: Me neither. It doesn't have the word "environment" in it.

Elisabeth: No, it doesn't have a lot of ... when I see a brochure like this, I would like to have it listed: what do you learn here, what courses will you have, what are you doing here? Like, page up and down ... I wouldn't have bothered to read it.

Emma: No, me neither.

Thus, Elisabeth and Emma were critical to the lack of information in the brochure as were some of the women who had applied to study the computer science and engineering programme, and also of the lay-out. They thought the brochure was appealing but neither very interesting nor informative. They would have wanted it more graphical and with an overview of the courses. However, both of them liked the slogan of women making circles and men making squares. They found it funny. The "Winning?" leaflet, they found even more amusing and neat. They also liked what it said about job opportunities. But they missed an overview of facts and courses here too. The most important, though, was what Emma says: "It does not have the word environment in it".

The interview with the two other women at Energy and Environment showed a similar engagement with the social aspects of the programme. One of them, Eva, had studied developing countries for one year and was thinking of continuing with social anthropology, but then she also wanted science subjects. When the Energy and Environment programme came along, she saw this as an opportunity to combine the two interests. It seemed to her that this programme included a more global perspective regarding working internationally, and a more social perspective with regard to environmental issues. Actually, she said, there was no other education that was interesting in this regard. Also, she had hoped that this could be related to her previous course in development studies..

She found out about the programme on the Internet, where she looked for information about different universities and programmes. She had also got hold of a brochure about the programme, and she remembered that she read it. Eva also saw the Women and Computing campaign. It was hard to avoid seeing it, she said; it was very prominent. This is what happens, she said, when something is new and gets profiled. . It was very visible perhaps because they had an updated web page and the most fancy brochures. But computing she did not find interesting at all.

Esther says that she always had what she called "a broad perspective". She had always been very interested in social science, literature and those kinds of things. At the same time, she had all the time had science subjects in school, because these were topics she felt she could not learn so well in her spare time. For these reasons, she was very uncertain about what she should study, and she considered several engineering programmes. But she never managed to be convinced, she said, so actually she thought about taking a year leave of absence to find out what she really wanted to do. But then a guy came and visited her school and presented, among other programmes, the Energy and Environment. She thought it looked interesting and applied. And since she always had been politically engaged in environmental issues and matters related to energy, she decided to enter that programme.

However, Esther had also considered computer science, mainly because she noticed that they wanted more women to study computer science and she thought that might be an exciting thing to do. She never had any particular interest in computer science, she said, it was just that it was so well marketed compared to other engineering programmes. But in the final instance, she chose Geology and Petroleum subjects. Not that she is technically interested, she said, she was just very concerned with solutions related to resource problems. Esther had seen circles and squares brochure, and thought it was "very cute". It was also the information that was most accessible. There was not much other information about other education available, she said. The advertisements were very much aimed at women who took science subjects:

We weren't that many who did that (taking science subjects, VL) in a way, and then ... when they then directed it very much to women who take science subjects, it sounded easier since they in a way already announced that they are engaged in having more women taking this programme. So, it might make it not such a difficult step to take.

However, eventually, she rejected the idea because she found out that she could not just study something because they wanted more women to study computer science. When she was interested in so many other things, it was not really an option. Paradoxically perhaps, Esther told us that it actually seemed more interesting now. Today, she might actually have considered it, but it was never an alternative when she decided upon her education:

Vivian: Why have you changed your mind?

Esther: Maybe because I didn't know anything about computing. I had some computing in upper secondary school, and it was a lot of But

now we have had programming, and we have had different subjects where we have used computer tools, and also in summer jobs I have had a lot to do with designing components in the computer and such ... that might be why I have taken an interest in it.

Vivian: What do you find interesting with computing now?

Esther: Perhaps I get fascinated by the fact that it is possible to understand if I spend some time on it (laughing). Because I had never expected that. I think so. And maybe also that it seems so logical to me, or that what lies behind is a logical construction when you look at it, that it is possible to imagine how things could have been made differently. Yes, it's quite a challenge. I think it's like that there are certain things that one wants to master, because it is an advantage to master it, and because there are really few who master it properly. So that might be the reason.

This can be interpreted as if Esther's early interest was much more career-oriented than professional. She put it the following way:

Esther: I did consider it, but once I really started to think things through ... I didn't have any interest. It was too distant. Like, it was nothing when I really started thinking about it.

Vivian: Did you have any ideas at all what it was about?

Esther: No, not really, I think. I think it was just an idea about how cool it would be to be educated as a master of technology in computer science, but I didn't know if I really wanted to take that programme. It's mostly the idea that ... it is okay to get a good education; it's a bit like that. It was 'in' to have an ICT education at that time. It was the big thing, and it was the future. One was thinking that if you had done that, and had that as a "luggage", then one could have done a lot of exciting thing, if one wanted to. (...) It is like that when you kind of get a personal invitation when it is so specifically directed towards women. And it was more that it wasn't the programme that tempted me; it was maybe ... it was just something that talked to me.

Eva: But it also sounded a bit difficult. It was a bit frightening when you don't know what it is all about, and it seem very complicated and difficult. And then it is not that easy to throw oneself onto it, as it is to throw oneself onto something that you are much more engaged in. I think we both are pretty engaged in public matters, and then it was much more fun to study something which we feel we have a slight basis for controlling, while this computer looked pretty incomprehensible. And then it seem quite scary, and not just a challenge, but perhaps a bit too much of a challenge, because you don't know anything about it

It is clear that the attraction of the computer science is mainly about the career opportunities, more than a professional interest. However, when the computer science and career opportunities are challenged by something they are really interested in per se, it loses out. Eva also points out that for people who do not know much about computer science, it might have an image as being difficult and perhaps also scary.

We also discussed the different campaigns. Esther remembered that she had got the circles and squares brochure from the counsellor's office, and Eva had seen it on the Internet. They remembered it, because, as they said, at that time brochures were not usually designed in such a fancy way, so it

distinguished itself from the rest. Esther did not like the front page as much as the inside of the Circles and Squares leaflet. She thought it had to do with the joke about women making circles and men makes squares that she have heard in four years now, she said, laughing. It is the eternal joke that is going around in NTNU, and it is a slogan that most find very stupid, she said. Eva, on the other hand, liked the front page better. She did not like the inside very much. She was mostly concerned about the lay-out. It was just pictures and compact text, she said. Eva would have preferred it differently, with not so many similar pages and perhaps more graphs and such. She thought it was a bit boring, because all the pages looked the same, and she would have wanted more different things to look at.

Thus, similarly to Elisabeth and Emma, they were critical toward the Circles and Squares brochure because it did not contain sufficient factual information, presented in a perspicuous manner.

Esther also made the interesting observation that she believed that female computer science students might be women that did not have very strong ideas about what they wanted to do, but that they had science subjects in school. The male students, on the other hand, she said, are probably very motivated and know perfectly well that they are going to work with computers. Women, she speculated, are there more or less accidentally.

This would be in contrast to the women students that had entered at the Energy and Environment programme. From the interviews, they seemed to have had a great interest in the subject, also fuelled by a political and social engagement with environmental issues. Although two of them admitted that they were tempted by the Women and Computing advertising campaign, it was mostly because it "spoke to them" because it was so specifically directed toward young women with science subjects and because it offered good job opportunities. It was not appealing because of a professional interest in computers. It was their profound interest in environmental issues, which in the end had made the choice very easy for them.

As previously mentioned, this programme managed to raise the percentage of women to almost the same level as the Women and Computing initiative, without any campaign directed particular toward women. The inclusion strategy was more general, directed to "everybody", and focussed to a greater extent on and described the content of the programme. If we compare these two strategies, it seems as if a message based on social (in this case environmental) engagement, could work just as well or perhaps even better than the rhetoric about gender differences and computer science, pursued by the Women and Computing initiative. It might be that a less stereotypical account would appeal to a broader audience of women and men.

5.2 Students that chose Informatics, Language and Culture

The Informatics, Language and Culture programme is, as described in the method section, a different kind of computer science education. The rationale behind interviewing female students in this programme was to investigate whether these women were potential users of the computer science programme, or whether their choice of a humanities-based education implied some criticism of computer science. Traditionally, in Norway, few women choose science subjects in secondary school. Consequently, the pool of women qualified to enter the computer science and engineering programme at NTNU is quite limited. Moreover, previous research has claimed that more women would choose computer science if it was embedded in social sciences or humanities (Kvande and Rasmussen 1989). The Informatics, Language and Culture programme is located in the Faculty of Humanities at NTNU and require no particular subjects in order to be admitted. Does this mean that the female students in this programme had a different interest in computer science, or would they have considered the computer science and engineering programme if they only had the required science subjects? What was their motivation to choose the one-year education? Had they noticed the Women and Computing campaign, and what did they think about it? Also, how did they think their own programme differed from the computer science and engineering programme?

Initially, we thought women at "Informatics, Language and Culture" would belong to the category that would appreciate the effort of the Women and Computing initiative to redefine computer science to highlight the importance of people skills. Thus, it came as no surprise when Irene told us that she chose this education because she wanted to focus on social science studies of technology, instead of just taking an ordinary computer science programme. She had considered the latter before she got to know about "Informatics, Language and Culture" through the lecturer who managed this programme, which she chose because "You get the point of view from both humanities and social science", she said. Previously, she had studied social anthropology for a year and a half. In upper secondary school, she did not have the science subjects required for the computer science and engineering programme, but English, Social Science and Informatics. She started to take an interest in computers already in secondary school, which she pursued in upper secondary school, by taking informatics as her optional subject.

Irene had also worked as a user support person at the university for three years, and she used computers a lot. Thus, she wanted to get some theoretical background to make better sense of her experience. Irene did not really think that she wanted to study informatics; she was actually quite fed up with it from school. But then she realised that she had actually worked so much with computers that it might be favourable to have some theoretical background as well. Our second informant, Ingrid, had also considered informatics first, because she had a general interest in computing. She told that she had always

looked for an opportunity to learn programming, but never really got started. However, she said that she was not very comfortable with science subjects; at least she did not want to engage thoroughly with such topics. Consequently, there were some computer science subjects she could not imagine she would enjoy either, like information systems and educational software. She thought that a combination of a humanities subject and some computer science would become more concrete and related to practical applications of computers. Ingrid was in the science stream in upper secondary school. Thus, she could have chosen to apply for the computer science and engineering programme, but she was not interested at the time.

Instead, she had studied media for a year and a half. However, Ingrid had all the time been thinking of studying something with computers. Media studies is a good thing to combine with computer science, she said. A lot has happened with newspapers on the Internet, which the kind of activity she would like to pursue. Ingrid also emphasised that when you do have a lot of experience from doing something, you need credit points to prove it. "It is not exactly very convincing to enter, as a woman, and say: I know a lot of computing". She had experienced that, and she knew that employers wanted more concrete proof of skills. She did not have much computing in school, but engaged in such activities on her own. Ingrid told us that she had been doing most kinds of computing; everything from putting a machine together to programming.

As we see, both Irene and Ingrid were interested and skilled in computing before they entered the programme. They even had some practice as paid employees. However, they had come to realise that without some theoretical background they would not benefit that much from their previous experience when applying for a job. As Ingrid pointed out, especially as a woman, you need to have documents and exams to prove that you really have computing skills.

For Ina, our third informant in this group, the situation was different. She had just recently been educated as a journalist, but she needed another one-year course. Ina had thought that it would be useful to have some kind of computer science because of the growth in Internet newspapers and similar changes in her profession. She did not really know the content of the "Informatics, Language and Culture" programme, she had just read about it on the Net. She thought it seemed relevant. Ina had no particular experience with computers outside leisure use. She got a computer when she was very young; her father taught computing. She told us that she liked it when she was in secondary school, but eventually got fed up. Since, Ina had just used it for educational purposes. Mainly, she had made use of features like image processing, layout, writing, etc. Both Ingrid and Irene were very happy with this programme, because they saw it as very concrete. Also, they found that computational linguistic was a quite technical subject, which they liked. As they told us, 'you don't make stupid small and fragmented programs that is just

suppose to input one figure and output another figure'. Ina found that there was much more computing in this programme than she had expected. She had thought it would be more theoretical.

None of the three women did have the sufficient amount of science subjects from upper secondary school to be admitted at the computer science and engineering programme. However, as mentioned, we saw them as belonging to an important part of the audience for the Women and Computing campaign. Thus, we were quite interested to learn what they thought about the advertisements. But when we showed them the Tom and Linda advert, Ingrid commented that they were a bit fed up with these campaigns because they have been analysed in detail at lectures.² Nevertheless, they looked at it and Irene commented: "I just wonder whether or not it is true? That men are technology fixed and women are people-fixed?" Ingrid said she think the message was made very much into a stereotype. "It is not very realistic", she said.

The Circles and Squares leaflet was met with more approval. . Ingrid liked it because she thought it was relevant what graduates actually had to say about the programme. Irene was ambivalent; she did not like the front page very much, but liked the inside of the brochure.

Because this is a very stereotyped picture, that I don't recognise.
Because all the people I know use computers one way or another, so I don't think it is as easy as that. But I think the inside is very sensible, because it is important to relate a programme to later job opportunities.

Ina, on the other hand, liked the front page of the leaflet because she thought that women and men *do* think differently. But she also said she felt that the Tom and Linda advertisement was made a bit too stereotypical.

Ingrid preferred the final advertisement campaign, "Winning?", because it gave more information about the programme, which was what she missed when she was in upper secondary school. "Some real information", she said. Also, it should have come to students at an earlier stage in upper secondary school. The last semester of the last year was too late; it should have been in the first year, she commented.

"Winning?" also triggered an interesting and critical discussion among the women about the gendering of computer competence. Irene told a story about being very angry with her boyfriend yesterday. He was tinkering with his machine, and then he said: Well, I don't know how interested you are in this?

And that is the sort of thing that makes me so provoked! And it is probably because I am a woman. If I had been a boy who also was skilled with computers (...) Many of the men I know between 20 and 30 years of age who work in computer science, do so because of the good money they earn. It's not necessarily that they think it is so fun to work with computers.

² These campaigns had been analysed in a lecture in a course on gender research

Irene said that she thought it was fun to do things and manage by herself; instead of just having others do it. Ingrid told that when she bought a computer, she bought it in pieces and assembled it herself. "That was so much fun!", she said. She did not receive any help either; she just did it by using an instruction manual. Irene continued:

But I don't see it as an antagonism. The way they put it (in the campaigns, VAL), it seems as if there is a contradiction between being interested in computers and interested in people. I don't think it is.

The others agreed. Ingrid commented that she believed that many women who say they do not use computers that much, but do it anyway, just are not conscious about it. They associated use of computers with the computer nerd, with whom none of them wanted to be compared, she said.

All the women knew something about the Women and Computing initiative, because they had received the same information as the other computer science students at NTNU. Irene had participated in two of the courses in programming organised by the initiative. She felt this was a positive contribution, because they had a lecturer in her ordinary programming course that had a "special style" – which was: "a programme-to-you –drop attitude", she said. This lecturer had told them that they should write programmes at least three hours a day. So, it was nice to get a different perspective on programming like what they got in the Women and Computing courses. The course was taught by a male teaching assistant. Both Ingrid and Irene had also considered other courses organised by the initiative.

It is interesting to note that both Ingrid and Irene were so interested and had so much practical skills in computing, compared to the women we interviewed in the computer science and engineering programme. However, as we have observed, they were not that eager to pursue computers professionally. Irene had to experience through paid work that more knowledge was required. Ingrid's motivation for not choosing to study computer science was that she did not want to destroy her pleasure of computing. If it became a job, she was afraid that she would become fed up. This raises some interesting issues related to young women's motivation to study computer science. The women students in the computer science and engineering programme, who had chosen to have a professional career in the field, were not that interested in computing. With Irene and Ingrid, however, we have encountered two women who were quite enthusiastic about computers. However, they chose to do something in between and entered a hybrid programme. If we would find something similar with the young computer enthusiastic women who attended The Gathering, this would provide an interesting and perhaps troublesome observation.

Even if Ingrid and Irene were rather enthusiastic about computers, it was also clear that all three of our informants had a pragmatic relation towards computing. One reason why they did not pursue a more comprehensive computer science programme was also that they saw computing as just one of

their interests. Irene was just as interested in anthropology, and Ingrid wanted to do computing in relation to something, for example media. Ina was just taking this programme as part of her training to become a journalist. This may remind us that computer science, like most other university topics, may just as well be a support subject, a tool to pursue a career in another professional fields. Computers have become ubiquitous and trivial; they are everywhere, and it is no big deal to use them. ICT is no longer a thing in itself, a set of technologies one needs to learn about and master. Instead, ICT offers new ways of doing interesting and fun activities as well as providing effective ways of performing a wide range of professional tasks. This may represent a potential to undo the existing system of gender and computer dualisms, when computer science and computer skills are observed to come sort of in different sizes – like a little, a lot or something in between. In this way, the dualism of to be or not to be skilled with computers may be replaced by a more heterogeneous understanding of both gender and ICT (Gansmo, Lagesen and Sørensen 2003). This idea will be pursued further elaborated in the next section about the young women at The Gathering.

6. Computer enthusiasts at The Gathering: Young potential applicants?

Participants at the Gathering were assumed to be enthusiastic about computers. Thus, we wanted to interview some of them partly because of their enthusiasm, partly because they should belong to the target group of the Women and Computing initiative. In the interviews, they were shown the printed version of all three advertising campaigns, in order to get their reactions to the way these advertisements had been crafted. We also elicited some of their views about gender and computing.

To begin with, it is important to recognise that the computer interest of all these 11 informants – including the two young men – should be considered to be on the moderate side. They did not belong to the round-the-clock enthusiasts. What characterised their use of computers was above all a kind of pragmatism. The personal computer was perceived as a tool to do fun things, but there was nothing special about it. All of the informants thought about computers as something that belonged in their everyday life; it was a trivial artefact that they would use to pursue the activities they liked to do; chatting, making web pages, downloading music or playing games. The main attraction of The Gathering, a large computer party, was to meet people. That was true for the young men as well as for the young women. Thus, the informants belonged to the group of people that are interested in computers, but not as their only pursuit. This means that our group of female informants should be considered as a major target group of the Women and Computing initiative – young women who are interested in computers, but who do not consider computers to be their main attraction in life.

To the young women as well as the young men, the computer was basically a tool to be used, not a machine that should be explored. However, they recognised that to some – mainly boys, but also to some girls – there were explorations to be made. Moreover, there was a varying degree of engagement with computers. This was related to the concept of being a nerd. Gunn defined a nerd as someone “who spends all spare time in front of the computer”. This definition was shared by most of our informants. To be a nerd was to be knowledgeable about computers, but it also meant that you spent much time with your computer.

More boys than girls were considered to be nerds. However, this was interpreted as an expression of the fact that more boys than girls are very interested in computers. When girls were very interested in computers, they became as skilled as boys. Most of our informants were quite wary not to engage with a clearly dualist interpretation, even if there were exceptions.

In this way, the construction of gender becomes more heterogeneous. It is not that gender is superseded, but rather that gender is invoked more carefully and frequently as a kind of average instead of a dualism. Qualities, like computer skills, are acquired – not given.

While we encountered examples of traditional ways of co-constructing gender and ICT, our informants tended to be careful not to link masculinity and technology. Rather, if such links were observed they tended to be explained away. In this way, our informants tended towards the naive. There might be differences between boys and girls, but these differences were just circumstantial. Nevertheless, they knew that it is common to assume that such differences exist, and some of the informants invoked gender differences in some of their accounts. Probably, this explains why their views of the advertising campaigns varied substantially.

To begin with, it is important to note that none of the informants questioned the need for a campaign to recruit more women to computer science. All of them recognise that there are fewer women than men studying such subjects. Thus, they accepted that there is a need to do something to change the situation. From this perspective, the informants tended to be positive about the campaigns, even if they might disagree about which of the three campaigns they saw as the best one.

In the first group interview, Gabrielle, Grethe and Gina agreed that the advertising campaigns were positive because they emphasised that one was interested in having more women as students:

Interviewer: What was ok with the campaign?

Gina: It is clear that they want more girls to study computer science.

Gabrielle: And it says that in a way that girls may manage just as well as boys.

However, these three informants were critical about what they perceived as efforts to stereotype men and women. Also, they were critical about what

they recognized as a lack of substantial information about computer science in the adverts.

In the second group interview, Gunn and Gro saw the adverts as a positive expression that students of computer science would learn a lot about computers. They were also positive towards the effort of depicting girls as different from boys:

Interviewer: What do you think about the symbols (in the circles and squares campaign)?

Gro: Yes, squares that may be very negative. I thought like this, eh, my parents are rather square.

Interviewer: How do you consider yourself?

Gunn: Very round.

Gro: Yes, very round. Creative in space, so to speak.

Interviewer: What do you feel that it really means, that girls are making circles?

Gunn: It means that girls are more creative.

Interviewer: Do you think that is correct?

Gunn: Yes.

Interviewer: Is this a good advert? Is there something here that makes you want to study computer science?

Gro: Yes, because it was a funny way to present it in.

Gunn: But there is not much information about the school or about computer science. But it could have made me want to read more about it.

Gro: What is in there about girls and computers and such is fine. It is fun to learn about girls who are into computing because there are not that many.

However, the two girls agreed that they did not want arrangements just for girls. As Gro put it, "It may be a little too much with girls only. It is a little fun to have boys in a class too. Then, there will be more of a competition between boys and girls. We can learn a lot from that too. Learn from each other".

The two women in third group agreed that there was something about the image of circles and squares that was catching.

Interviewer: It (the advert) states in a way that girls are making circles and boys are making squares. What do you think about that?

Grethe: That means that girls think somewhat differently than boys. That is in a way true.

Interviewer: How do girls think differently from boys?

Grethe: It is like this that boys are thinking more straightforwardly, while we think around issues.

Interviewer: But is this a good advertisement, you think, if you wanted to study computer science, do you think that it gave you a greater interest to start with such a thing?

Grethe: I think so.

Guri: (confirms).

In the fourth interview, the mixed group of two boys and two girls, the informants were more careful when voicing their opinions. However, they accepted that such adverts might have a role to play, even if they thought that the message could have been more outspoken about equal opportunities for men and women.

While the advertising campaigns by and large get reasonably good marks by these informants, the overall message resonates in a rather strange way with the future plans of these young women. None of them planned to study computer science; in fact, most of them had chosen a set of electives at upper secondary school that made it impossible for them to enter a computer science programme at any of the universities. This was not because they feared computers or expressed any anxiety that computer science was a male-dominated subject. Rather, they do not find computers that interesting, or they have found other careers that they perceive as more tempting. Or, it was like we observed with the women at the "Informatics, Language and Culture" programme:

Interviewer: What would it take you to choose an education in computer science?

Gabrielle: Maybe not so much, really. But in a way, it may be like that is better just to let it be, what you are particularly interested in. Then, you can work with something else.

Grethe: It is easy to get tired ...

Interviewer: But you, you have had some computer topics at school. Would you consider pursuing this?

Gina: No, well, I really don't know. At least, I will not work with user support. That is no fun. But it may also be because our teacher wasn't very inspiring. We just worked with access.

It is interesting to note that even among these women, who appear to be some kind of computer enthusiasts, computers are in a sense getting trivialised. They may be fun to play with, but this does not mean that computers are such a great deal. It is something you may learn about and use in varying degrees.

7. Activities to retain women: How the female computer science students experienced socialisation strategies

The previous section has focussed on inclusion strategies as efforts to recruit women to computer science. However, it is a well-known problem that female students may choose to leave a computer science programme. Thus, recruitment is necessary but not sufficient. It is also important to retain the female students.

The Women and Computing initiative included inclusion strategies that aimed to retain female students, which we have called socialisation strategies. They included the establishment of a computer lab for women only, called Cybele, the use of a female lecturer in the introduction course, the establishment of a course meant to explain to students what graduates could be doing in their future jobs, and some lectures by practitioners that were supposed

to provide role models. However, as noted in the companion report (Berg 2002), the main effort of the Women and Computing initiative was in the recruitment area. Nevertheless, we were interested to know what the female students thought about the socialisation efforts.

Generally, all of the female computer science students interviewed were positive towards the Women and Computing initiative. They thought it must have been much better for them than the previous year, when there were only 5-10 women in the class. They felt that they had experienced a lot of attention from the "outside", but not so much from the students in the programme. They also had the opinion that the male students were positive to the initiative and the quota, because it was better for the atmosphere:

"I think it [the quota] is positive for both boys and girls. I think the boys are very happy that there are not just boys in the class. That would be like being back in the army. (...) the culture becomes much better (...)" (Christine)

"They know ... that it is not such a big difference in the marks from school between those admitted on the quota and the others. So, they know that we are not inferior to them. (Celina)

The women also expressed astonishment over the commotion and fuss in the media and elsewhere because of the initiative and especially the quota:

"Yes, actually it has been very much [focus in media on the quota]. It's like they never get tired of it. It is "Women and Computing"... "Women, women"!" (Celina)

They also admitted that they got a little tired of all the attention on women themselves. Celina had worked as a teaching assistant for 2-3 years, where she and others had tried to arrange things for women in the programme, like social events, courses, etc. When we asked her whether these things had worked out, she said:

"I don't know if I can comment on it now, because I really have it up my throat at the moment ... I have been so intensively engaged with all this women, women, women for three years. So, this last year and six months, I did it primarily because I could use the money. So, it became a little bit too much. But it works fine for those in their first year of study. They are very happy that the milieu is there, and that they can participate in courses, lectures and different other things." (Celina)

None of the women we interviewed had used the Cybele lab very much. Mostly they used it to check mail and if they needed the scanner. When they were working, they would normally use the other computer labs, because they often collaborated with other male students. The Cybele lab was also debated among the female students we interviewed. Some thought it was okay and some thought of it as unfair with regard to the male students:

Vivian: Have you made use of the lab?

Charlotte: Mainly the first year really. I have used the scanner.

Carina: I have not used it, because I think it is so terribly unfair. I think I have been there once or twice. But I think it is terribly unfair.

Camilla: I think I used it a lot the first year. But I haven't used it that much later, because if you are in a group with boys, you can't use it if you are going to sit and work there. But it would have been easier to find a machine there.

Christel: In a way I don't think it is unfair either. It's women that has made this and got hold of sponsor money in order to create a milieu and well-being, and in a way ... what we really have done is just to occupy a room. Anybody could have done that, and got the same thing if they had wanted to.

Carina: But the point is that these boys hadn't been allowed to do the same thing.

Celina: No, but then they haven't tried either.

Carina: No, they haven't tried, but we do know very well that if they had, it would have been reacted harshly against.

Christel: That's not our fault.

Carina: Yes, but the point is that even if they had done the same thing, and got money and all that, they would never have been allowed because it would have been deemed discriminating. I am certain of that. Do you really think that NTNU had accepted that there was a computer lab where only boys were allowed? I can never imagine that!

Vivian: But I have heard that before all the women came to the programme, there were computer labs that were so male dominated and with a culture that made many women hesitate to use it. So, in a way that was a computer lab mainly for boys?

Carina: I understand that it was a need for it when it was established, but the point is that things have changed very much, and I would really wish that instead there was a room with a sofa and a waffle iron and a TV, instead of a computer lab. That is what I had wanted. But then I don't use any of it, so I have really no right to speak my opinion, but that had been fairer, I think.

Another effort was to use a female lecturer to teach the "IT-Introduction" course, which was a basic course, aimed at giving a broad overview of computer science. However, the only female lecturer that was worked in the department was Italian. Several of the female students we interviewed told us that they thought this had been a difficult course and that there had been a language problem

I actually think that was part of the problem ... I don't know ... in the first IT-introduction course we had a female lecturer. I don't know if that was a deliberate action. But we actually had some problems with it, simply a language problem. She was Italian. I think to get such a start on the IT-intro course was not very fortunate. Because, I sat and was very fascinated by her who stood there and lectured, and she was probably very good too. But I didn't understand what she was saying. (Camilla)

Carina, who had been working as a student assistant, told us that this course now had been improved. It had become less technical, and they had also added some support arrangements. She said that the course had been given a good evaluation now, and that it had become easier to follow for those who did not have any previous knowledge about computers.

The "Know Your Subject" module that was offered was a course where each student team visited a company. Before the visit, they would have discussed and prepared questions to ask. After the visit, the course included using and thus learning some technical facilities like electronic meeting rooms and the making of web pages, when they discussed and prepared a joint presentation of the company that had been visited.

However, most of the female students we interviewed, expressed negative points of view about this course. Their main argument was that the visit at the company had been experienced as scary. They were very fresh students at the time of the visit (the course was in their first semester) and hearing about what one was suppose to do and know when one started a job, had obviously been a bit too much in this vulnerable situation.

We couldn't do anything, and people sat there and said that they developed, systematised and wrote programmes, and "I sat alone and programmed a little when I started the job", and those kinds of things. And then, we, the small first-year students sat there and just: I don't dare to do this! Right? So I remember that we actually talked about it after we had been there. That it actually had the opposite effect than probably intended. (Camilla)

Another feature was that all of them had got a bad impression of the company they visited and decided that they would never work there in the future.

All the students, including the female students we interviewed, were entirely positive in relation to having control of the gender composition of teams of students that were supposed to work together. This gave them a good opportunity to get to know other women, since they usually spent most time with their team and these were the people they got to know the best.

8. Making computer science into a place for women?

In this report, we have analysed the Women and Computing initiative from the perspective of young women who could be considered users of the initiative. We have included five main groups of potential users:

- Young women students in the computer science and engineering programme at NTNU
- Young women who were admitted to this programme, but declined the offer
- Young women students at the Energy and Environment programme at NTNU, a new engineering programme that has attracted quite a lot of female students
- Young women students at the Informatics, Language and Culture programme at NTNU, a one year course organised by the Faculty of Humanities
- Female adolescent computer enthusiasts, whom we interviewed at the large computer party The Gathering.

What does it mean to do a user study of an inclusion effort like the Women and Computing initiative. In section 3, drawing more broadly on technology studies research on users, we introduced five different version of the “problem of the users” from the perspective of the designer (Aune et al. 2002):

- The attractiveness problem
- The identification problem
- The problem of the non-users
- The problem of instruction or control
- The usability problem.

We will use this taxonomy to summarise some main findings.

With regard to the issue of attractiveness, it seems clear that the Women and Computing initiative has been able to help recruit quite a lot of young women to the computer science and engineering programme. In this respect, the initiative has been a success. Most of the women we interviewed had noticed the campaign. Many of the female students that actually entered the programme told that they had been influenced by the campaign when they chose computer science and engineering rather than one of the other engineering programmes at NTNU.

The attractiveness of computer science was mainly perceived by the users/students as related to good career prospects and the relative high status of the education. Also, it was important that the initiative helped to signal that women were welcome in the programme and that there were quite a lot of women students in the programme already. Many also appreciated the message that they did not need to have a lot previous knowledge about computers to succeed as computer science students.

The advertisements made by the initiative tried to make computer science attractive to women by redefining it from being technologically oriented towards being more oriented towards people, emphasising the need for traditional feminine qualities like communication skills and empathy. This effort does not seem to have been domesticated by the students, who were not very concerned with these aspects. Their understanding of computer science tended to be quite instrumental and pragmatic. It was a sensible education that would provide good jobs. The effort to redefine computer science was rather interpreted as a way of getting women’s attention; it was not taken seriously. The dualistic message in the campaigns was more or less was filtered away by all the women. One possible explanation might be that young people today are so used to and skilled in handling commercials and advertising that they effectively see beyond the messages and focus on the product, in this case, the computer science and engineering programme.

The main target group of the Women and Computing initiative was young women in their final year of upper secondary school, who had chosen advanced courses in science and mathematics. It was these women who could

be admitted to the programme. The outreach from the initiative in terms of sending promotional material seems reasonably successful, since most of our informants had taken notice of it. However, the content of the material was characterised by an identification of its readers as someone not so interested in science and technology. In this way, the campaigns could be criticised. They overlooked the fact that most of the women actually entering the programme were generally motivated to study science or engineering, and that these women would be more interested in factual information about the education, rather than criticism of hackers and their mentality.

An interesting distinction may be made in relation to the perception of the different campaigns. Both Tom and Linda and Circles and Squares were early examples of efforts to use professional advertising to promote university education programmes. Tom and Linda's used irony as a main strategy, while Circles and Squares was very modern, symbolic and glossy. Several of the informants mentioned that the campaigns were a bit sensational, compared to other information they received about higher education. Also, it was profiled very directly toward young women with science subjects, and it was distributed in a quite personal way, directly to the individual woman. This made them quite aware of the programme and also of the Women and Computing initiative. In addition, there had been extensive mention of the Initiative and about women and computer science in the media at the time the computer science students we interviewed was about to choose their future education.

However, recently, this way of advertising higher education has become more and more common. As we saw, the women we interviewed who had turned down the offer of studying computer science, were not that impressed by the Winning? brochure and some were quite critical. Some barely remembered it. It is tempting to believe that this most recent advertising campaign no longer benefits from the advantage of being innovative and that it received less attention than the two first ones did.

Given the broad scope of the Women and Computing initiative in their efforts to target young women with advanced courses in science and mathematics, it is obvious that the great majority will end up as non-users. By this we mean that the great majority will choose a different education, and this does not mean that the initiative has failed. However, the group of women that had been admitted and who declined the offer could be a source to identify weaknesses in the campaign. But the interviews with this group did not really point to serious deficiencies in the inclusion strategy of the initiative. To choose a higher education is to choose your future in a quite decisive way, so there is no reason to wonder that some change their minds.

Still, it is interesting to compare motives of users – women actually entering the computer science and engineering programme and women who decided for other educational options. As noted above, the arguments that made the greatest impact on the women were those that focused on job and

career opportunities. It may also be interesting to note that none of the women interviewed mentioned maternal or family considerations as a factor that influenced their choice of study. This might perhaps be related to the relatively extensive paid maternity leave in Norway (12 months), and also the relatively high percentage of men taking some parental leave when the children are small.

In particular, the female computer science students seemed to have been quite instrumental in their choice. They were generally motivated to study science and engineering, but not especially interested in computers. They appeared in the interviews as rational, instrumental and moderate. This may be seen in relation to a widespread discourse about gender and ICT, probably strongly influenced by state feminism (Gansmo, Lagesen and Sørensen 2003). It is based on a dualist understanding of gender as well as ICT. In this discourse, women are presented as instrumentally oriented towards ICT, a technology that is an important tool and something everybody needs to know. This is used as a basis from which to construct a kind of "sensible" feminine relationship towards computers, in contrast to a silly masculine enthusiasm expressed through reference to the hacker stereotype. The "sensible" feminine relationship is characterised by the idea that people skills should be front stage, while the technical aspects should be backstage. The strategies to include women as users of ICT or as ICT professionals implement this construction by saying that computers are important means to an end, but nothing else.

Men, on the other hand, are in these campaigns presented as enthusiastic about computers, which is an object of play and even deep engagement. The hacker figure might be seen to represent an image of the inherent dangers of this approach; too much enthusiasm, too much commitment, and too little concern for utility? Thus, we get a construction of a masculine relationship to computers, where technical skills and technological enthusiasm are front stage, while people concerns are moved backstage. This relationship becomes a problem because it provides an unhealthy relationship to computers. To provide industry and the rest of society with the skills and values needed to create a productive and pleasant Information Society, ICT has to be moved out of the 'boy's room' (Gansmo, Lagesen and Sørensen 2003).

However, the problem with the state feminist strategy towards ICT is that it reproduces gendered dualisms that in turn help to reproduce gender differences in relation to ICT. The sensible feminine relationship towards computers may for instance lead to an experience of computers as boring and uninteresting. On the other hand, the masculine experience of ICT as an object of play and enthusiasm is denied or denigrated. The state feminist discourse does not allow this enthusiasm, which has been seen as a source of the exclusion of women. In a way it is made a secret, locked up in the 'boy's room'. Even if it did not seem that the dualistic message was deemed very important by the female computer science students, judging from the outspoken instrumentalism in their accounts of their motivation for studying

computer science, the message may have been appropriated indeed. Enthusiasm was surely de-emphasised, compared to sensibility and instrumentalism. One might ask whether it was considered gender inauthentic for the women student to admit that they enjoyed computer science?

Interestingly, it seems that there were more computer enthusiasm among some of the women that decided not to accept their study place. These women also emphasised that what they had learned from the advertising campaigns was that there were women at the programme and that there were good job prospects and career opportunities. They did not mention that the brochure made computer science sound fun, and one of them criticised it for saying that women preferred to read instead of fiddle with the computer. This was the only critical mention of the stereotyping. Judging from what these women said, it seems that the brochure did not manage to create much enthusiasm for the programme in itself nor did it provide much information about the programme.

The main motivation of the women who had chosen the Energy and Environment programme was definitely their interest in the study subject, which included a general engagement with social and political aspects of their education. Some of them were not negative in principle to study computer science, but because of their strong interest in energy and environmental issues, it was never really an option. Also the women who took the one-year course in Informatics, Language and Culture expressed a stronger professional interest in their education.

Thus, we may wonder if the Women and Computing initiative has missed the group of young women who have a more enthusiastic relationship towards computers and, potentially, also to computer science? At least, there is no doubt that the main image of female computer science students, expressed in the promotional material, is a moderately interested, instrumental and rational young woman. This relates to the fourth of the above-mentioned user problems, namely the issue of instruction or control. Has the initiative been able to provide designs or actions that make users act in a relevant manner? The success of the initiative in providing a major influx of young women to the computer science and engineering programme suggests a positive response. However, if our conjecture about the initiative configuring young women as moderately interested in and instrumental towards computer science is correct, then the issue is more open. Our study does not allow a conclusive answer, since we have not studied how the young women in practice approach computers and domesticate computer science.

The usability problem related to the Women and Computing initiative raises the issue of the effectiveness and appropriateness of its socialization efforts directed at the young female computer science students. In this study, we asked them to what extent they made use of and/or considered such efforts in a positive way. The students admitted that the quota for women and the Cybele lab had been contested issues, but the dominant view was that everyone, including the male students (or perhaps especially?) thought it was

positive for the atmosphere to have a substantial amount of women in the programme. The male students did not suffer because of the quota, since they had already been admitted. The Cybele lab had been controversial but received little attention now, according to our informants. Some of them used it sporadically, but the capacity was limited due to unstable running and somewhat outdated equipment.

The “Know your subject” module - another inclusion effort – was not perceived to have been a great success either. The female students reported quite negatively about the visit to companies as a fearful experience. They did not mention the other aspects of the course, like the webpage-making and electronic meeting room, which were considered quite positively in a study from 1998 (Berg and Kvaløy 1998). However, even if the particular inclusion efforts were not considered particularly successful, there is no doubt that the female computer science students in general felt included and comfortable in the programme. Many emphasised the importance that there was a great number of women there. The culture was presented as supportive and good, where everybody helped each other, both men and women. Perhaps, in the end, the most successful inclusion effort was in fact to raise the number of women?

Thus, in many ways, the female students – and probably also the men – had domesticated the Women and Computing initiative in a quite successful way. They had been able to develop a practice as students, which they report as satisfying. Also, the symbolic representation of computer science as instrumental, rational and moderate seems compatible with the way these young women expressed themselves in the interviews. However, as noted several times before, it may seem as if the symbolic representation of computer science implies a “sanitised” construction of ICT. The campaign and its domestication seem to resonate well with the idea that computers mainly are useful tools that should be employed in an instrumental, rational and moderate way. This construction makes computers and computer science into something low-key and trivial. Computer science is important and interesting, but in a restrained sense. It is not The Key to the Future, as depicted in the larger Information Society discourse nor is it a pathological a-social obsessive activity. Rather, it may be a key to individual, quite “normal” professional careers.

9. A brief note on policy implications

The Women and Computing initiative helped increase the percentage of women computer science students from 5,7 % in 1996 to 37,7 % in 1997. This percentage has remained high since, although it has been dropping a little in 2002 and 2003, maybe due to the perception of a stagnating labour market for computer science professionals. Still, it has remained relatively high. Thus, there is no doubt that the Women and Computing initiative has been a success in relation to its prime goal.

However, it is not quite clear what features of the initiative that were most important to achieve the remarkable results. In practice, the quota for women was important because it actually meant that more women were admitted than would otherwise have been the case. That our informants chose not to focus on the quota is to be expected since it might be seen to put women in a less positive light in relation to the initial academic standing. We should conclude that the quota has been important, even if it is a sensitive and contested issue.

The women themselves emphasised particularly that the campaign made them feel welcome and wanted as computer science students, a feature they really appreciated. In fact, while they are critical to many parts of the inclusion strategy, in particular the advertising campaign, they remain generally positive about the initiative. Thus, it is tempting to interpret the main outcome as a kind of "Hawthorne effect". It was not one or several of the measures implemented that made them apply and to choose to study computer science, but rather that there was a highly visible initiative to recruit more women to computer science that after the initial success also could guarantee that there would be a considerable number of women in the study programme.

This means that probably, the most important part of such an inclusion strategy is to have a highly profiled initiative that explicitly states that more women are wanted as students. The arguments why this is important do not seem to be that important, nor what other actions that are implemented. The main issue is to be visible with a clear statement about a wish to recruit more women. In order to achieve this goal, one probably needs a broad-spectred set of inclusion measures and an advertising campaign with coverage similar to the one found in the Women and Computing initiative.

On the other hand, one should strive for campaigns with a more informative and more heterogeneous message. The play on gender and ICT dualisms in the advertisements was seen by some informants as catching and entertaining, but not really appreciated by any of them. The cyberfeminist message that women were particularly suited to study computer science seems to have been overlooked or, perhaps, translated to mean that 'we want women to apply'. The women students mainly said that they would avoid such stereotypes, probably because use of dualistic gendered images would be problematic for them in the long run. They wanted to be valued for their individual qualities, not because they were women. Even if their accounts showed that gender were sometimes mentioned as an aspect of the culture at the department, they invoked gender in a very careful and heterogeneous way.

The emphasis on status and future career possibilities is also noteworthy. The choice to study computer science is generally embedded in an outspoken interest in mathematics and science subjects. Thus, to construct campaigns that resonate with the assumption that women are not really interested in science and technology subjects, that they all want to work with people, may be viewed as a disservice to them. First, because such campaigns do not provide

such women with the motivation and information they feel they need (cf. Therese's case) Second, they confirm rather traditional images of men and women. Why should traditional women make untraditional choices?

The measures in the Women and Computing initiative that addressed socialisation concerns seem less successful. Probably, this has not been critical to the success of the overall project, since the drop-out rate has been relatively low. However, we should note the problematic image of the Cybele lab and the criticism made of the industrial visits that were intended to make the study less abstract. If we compare with the Carnegie-Mellon inclusion initiative (Margolis and Fisher 2002), what happened at NTNU was not sufficiently focussed at problems related to the lack of role models and the potential feeling of being less competent than the young men who had spent most of the adolescence in front of a screen. There may be a greater need for curricular reform than what was achieved in the NTNU initiative.

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