Towards a happy ending for girls and computing?

Helen Jøsok Gansmo

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Department of Interdisciplinary Studies of Culture

Faculty of Arts

Norwegian University of Science and Technology

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GIRLS AND COMPUTING – WHAT IS THE PROBLEM?

Setting the scene

> *Once upon a time in the promised land of Information Society there was a widespread concern for the dreaded Digital Divide.*

In the wide range of modern stories and "fairytales" in our techno-romantic era, access to and knowledge about computers always seem to hold the key to a prosperous future, while deprivation of such access will doom you to the far side of the Digital Divide. ICT (information and communication technology) thus seems to be the driving force of the 21st century as the electricity was for the 20th. As a result, the policymakers of Norway, even if, or just because, they rule a small country, are afraid of falling behind on the golden route to the future, and thus aspire to be on the right side of the digital divide. This is in accordance with general concerns in other countries and the EU about lagging behind, since they have observed that Japan and USA have been leading the way enroute to the Information Society (Selwyn 2002, Servaes and Heinderyckx 2002). This is also a double drama because as in the traditional fairytales, princesses are in special danger or have wandered off and must be rescued by the heroes:

> *...knowledge in technology must be shared by all groups in order to prevent new differences from developing in the presuppositions for participation. Dissemination must thus proceed so that it does not consolidate traditional gender divisions where girls are raised to believe that "women do not understand" natural science and technology.*[1]

Girls and computing has been a topic in the Norwegian public discourse since "once upon a time" around 25 years ago, and I will through this collection of articles investigate various stories about the girls and computing problem at different sites and look into how these stories relate to each other.

News coverage, White Papers, researchers and the public at large all seem to be concerned about ICT, Information Society, Digital

[1] Quoted from chapter 4.6 in St.meld. 24 1993-94 Om informasjonsteknologi i utdanningen (http://www.uio.no/offentlig/stortingsmeldinger/St_mld-24.html.kap4.html, page 5 of 6, downloaded 06.06.99). This is part of a quote from the general curriculum, but the White Paper does not state specifically from where in the curriculum.

Divides or gender gaps in one way or another: It is generally seen as important to catch up with ICT knowledge. True, some critics are sceptical towards the side effects of too much ICT in society, but generally, despite Norway being densely equipped with computers both at schools and in private homes, the main concerns revolve around lack of adequate access to computers for kids. Further, not enough girls are interested in ICT or choose to work in the ICT industry; besides, girls seem to apply ICT differently from boys.

I was personally intrigued by the issue of "women lagging behind" because I could relate to many of the princesses in these stories: For Christmas 1984 my younger brother and I received a Commodore 64 from our parents for "educational purposes". Since the computer came without educational manuals and since it was Christmas holiday, we were allowed to borrow some computer games from my brother's friends. Almost immediately the computer was transformed from education to entertainment, which I did not necessarily mind. What turned me off the entertaining computer was that it constantly attracted young brats to the house, and even more, that my brother was so engaged with it that he left all the household tasks to me. I thus decided to pursue the educational part of computing through an elective computing course in secondary school. We had a male teacher and I can only remember male classmates in that course, but that was not a problem to me. The problem was the unappealing content of the course and the lack of access to computers. We were taught to program on paper and with no clarification of context or the benefit or purpose of making a program. Thus, I decided that both leisure and educational computing were uninteresting to me. This view was further reinforced when I as a first year college student had to take a computing course, which once again was taught more or less without any hands-on computer experience. As a silent protest I still have not passed this course, but I have nevertheless, on my own, developed computing skills far above the average user level. The basic skills came when my studies required the use of computers or when the use of computers would simplify my work. I even bought my own computer and soon also became a wizard on e-mail and Internet use; I even own my own discussion forum on the Internet. Thus, many of these digital gender divide fairytales could have been about me, except that I managed to eventually be included in the Information Society. Was I the odd girl who confirms the rule? Are other girls in need of rescue, and if so, why?

Looking for a better understanding of the girls and computing problem, I, as a modern researcher, surfed the Internet for more information. I then found the Norwegian Ministry of Education and Research's publications regarding girls and computing. This web page

describes several school projects and research projects related to girls and computing. I also found *One click and you're hooked – an inspirational brochure for girls and computing in elementary and secondary school*.[2]

Why is it that girls seem to need special inspiration in order to become interested in computing? According to this brochure girls are eager to learn but are selective in what they find useful and important in order to use ICT. Girls like to use ICT to communicate and build networks. Girls and boys have different approaches to new technologies, which means that girls are falling behind. The booklet recommends that we should let the girls have fun, let them do what they like, let them take part in social female networks on the Internet and make use of chat lines. Further, it reassures girls that technology is not dangerous – girls just need the guts to try!

So, according to this inspirational brochure girls are in danger of loosing out on some very important knowledge and competence in ICT, apparently because they are afraid of the computers. The public discourse on girls and computing seems similar. We can constantly read in newspapers that ICT makes the world smaller, but that the gap between girls and boys seems to widen; a culture seems to have developed where women feel just as welcome as computer viruses. Aftenposten, a leading Norwegian national newspaper reported on October 16 1994:

> *One who for the first time logs on a new computer, eager to explore the new world, with the loudly praised "information high way", all kinds of databases, breakneck games, multimedia and accompanying amenities, soon comes to learn to read the message in small print: This demands 370 MB, support for SCSI-2, according to SPECfp92. In practice the message is exactly the same found on the doors of many boys' rooms: Warning! No girl lice allowed! - The computer is the boys' tool, or should we say toy?*

Other newspaper articles have over the years reported that computing *is* the future, but according to educational statistics only boys take the consequences of that. Girls learn at an early age that computing is not for them.[3] Women are too little involved in the shaping of the computer society.[4] More boys than girls receive computers from their parents or relatives. Young girls encourage adults to also give Lisa a chance to learn computing, not only Petter. Computer advisors agree, but make a

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[2] http://odin.dep.no/archive/knvbilder/02/92/klikk008.pdf
[3] Aftenposten 1985-02-22
[4] NTB 1987-03-16

warning: Give Lisa a computer but not at any cost, and not only for the computer it self. The main issue must be to demonstrate how she can make use of it.[5] For every female buyer there is four men. John is the big spender on computers, but Jane is following, and is more rational on getting her money's worth. Women buy word processors and other computer equipment for their home office or because they need it in their job. Exploration of new possibilities in machines and programs is mostly a male interest. To women usefulness is more important than games, and girls have a better understanding of the use of computing in society than boys do. The girls are also more critical towards the computer society.[6] But, no matter what trade you choose, it is important to know computing. Unfortunately, studies in informatics are best suited for men amongst other things because male experiences are applied as a basis for the teaching.[7]

Thus, the Information Society has somewhat been pictured as a hostile environment for women, but nevertheless an environment they need to enter in order to prepare for a prosperous future, just as the men apparently have done.

Research proposal: Are researchers, policymakers, school administrators, computer game designers and teens online?

This widespread focus lead me to propose a research project focussing on the relation between understandings of ICT and understandings of gender in society. I wanted to investigate how ICT was pictured in order to visualise implicit notions of gender influencing use and appropriation of ICT in schools and teenagers' everyday life. Thus, I aimed at studying the gendered processes around ICT dissemination, the cultural frame around a seemingly neutral ICT, the myths that were produced about gender and ICT.

The impression from the Ministry of Education and Research's homepage and the news coverage is that there is a general concern about equal access to computers for all, and through this, the role of computers as the key to the future is consolidated. Similar processes have taken place in other Western countries, and Neil Selwyn (2002) shows how media, politics and industry in the UK have constructed a desire for the educational computer and contributed to cementing the link between education and ICT in the public's mind, leaving the association of the computer with education and learning as unquestionable common sense.

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[5] Aftenposten 1987-06-06
[6] Aftenposten 1987-12-16
[7] Aftenposten 1989-11-04

Still, the introduction of computers into education is also to some extent distrusted as controversial, amongst other things because many different players with diverse interests are involved, particularly on the "push side". Sonia Livingstone (2002) concludes that the existing research literature is not yet sufficiently developed to determine the specific advantages brought about by access to new information media. She refers to Cordes and Miller (2000) who have reviewed a body of evidence critical of the claims that use of computers in schools improves educational achievement, suggesting rather that computers undermine creativity, isolate children from face-to-face communication, and distract educators' attention from children's needs by focussing on the technology instead. Livingstone adds that new evidence expands rather than resolves confusion because scientific debates are also informed by policy, politics and morality.

This dissertation is not an evaluation of potential usefulness of implementing computers in school. Rather, Selwyn (2002) claims that there is a pressing need to explore how and why the computer came to occupy its current cultural position as educational tool, and that such a study needs to start from the premise that the nature and qualities of the computer are not intrinsic and merely shaped by technological processes. Technologies and their qualities must rather be seen as socially constructed, shaped and configured by a variety of actors. My project is somewhat a parallel one, and thus I adopt Selwyn's premise with an added gender focus.

A wide range of studies in education demonstrate that the school is an arena where identities are shaped, often in ways which reproduce inequalities between pupils in general and between boys and girls in particular. Sarah Holloway, Gill Valentine and Nick Bingham (2000) take this assertion one step further and report that the highly gendered institutional cultures in British secondary schools are multilayered due to being shaped by official school policy, teacher practice and pupil culture, all of which combine to produce distinct cultures of computing at different times and places within the case-study schools. Further, the relationship between computing, gender and education connects to the broader political in so many ways that to focus only on the classroom can no longer suffice. Thus, the study of technology and the sociology of education need to reconnect within a broader critique of society if women's continuing oppression is to be understood (Clegg 2001).

In accordance with Clegg (2001) and Holloway, Valentine and Bingham (2000), I thus decided that the girls and computing questions needed to be investigated as multilayered as such and also at different sites through reviewing previous research and through conducting my

own research on different actors who (supposedly) are concerned with the issue or affected by it.

The aim of this dissertation is thus to investigate the content of the girls and computing problem as it is constructed by research, policymakers, school administrators, computer game designers and of course the end users themselves, the teenagers who are supposedly at the threshold of, or are born into the Information Society, and further to see how these constructions relate to each other. I thus try to see how the policy of including girls as computer users is embedded in different practices, and each site is described in separate articles. The choice of focusing on these different sites or actors should be evident from the descriptions above, except for the computer game designers. Inspired by Hendrik Spilker and Knut H. Sørensen (2002), I find it interesting to contrast the policy strategies with enterprise strategies, and to see whether actors with a market perspective see girls and computing as the problematic relation it is made to be in other connections, and thus as a potential for profit. The design of this dissertation is thus based on expectations of links between the fairytales the different actors tell. Initially I chose fairytales or stories as a metaphor for the political and public discourse on girls and computing, because it referred to the well-known ingredients in such narratives: damsels in distress rescued by wise heroes. On a more reflexive note it is important to add that I do not consider these stories as unreal in any sense. On the contrary, the different constructions that take place in such stories constitute what different people perceive as real. Further more, the constructions in one story may reinforce or contradict constructions in another. Thus, I expect to find traces of the same stories in all sites investigated in this dissertation. Further, this dissertation itself may also be seen as one of these fairytales which will/can contribute to the constructions of subsequent stories.

I do not intend to look for the originator of the girls and computing fairytales. But, since one of the rationales for the existence of the State is provision of governance, and since the aim of good governance is the provision of justice and the reduction of inequality (Hernes 1987), I expect that the policymakers' constructions of the girls and computing problem will have significance for the other actors' stories, and I thus started my research with analysing the policy and the policymakers. Further, I also expected that research of the problem may to some extent work as an intermediator for (some of) the different actors. In the next part of this introduction I thus aim to describe how the girls and computing problem has been explored by different researchers over the years. Since *women* and computing is an "older" problem than *girls* and computing, I start briefly with the former in order to provide some

context for how the young girls and computing problem has been explored.

Girls and computing – how has the problem been explored over the years?

Much research conducted between 1977 and 1990 show mounting evidence documenting the existence of a technological gender gap (Canada and Brusca 1991). To some extent gender gap research is conducted on all age groups from kindergarten children to senior citizens, and in many spheres of life, such as school, work, higher education and leisure activities. But it is probably the synchronised focus on the need for more people working in the rising ICT industry and the decrease in number of women completing ICT degrees which has been most noticeable (see Berg 2000 for a review). This much focussed decline in number of women studying computer science is further seen as remarkable since the number of women in most other university subjects has been increasing (Robertson et al. 2001).

Women and computing has not always been a "gap issue", though. Women too have made valuable contributions to the development and application of computers: Ada Lovelace was the world's first "programmer"; in the infancy of the computer industry in the 1960s the majority of the operators were women; even in the beginning of the 1980s women were seen to be equally as interested in computers as men were (Lockheed 1985).

Since technology and its qualities here are seen as partly socially constructed rather than purely technical, it is important to note that it is not necessarily the technology it self which triggers or halts people's interest in computers, but rather the perceived use and context of the technology. In the 1960s, when few people had first hand experience with computers, people's attitudes were heavily influenced by science fiction's portrayal of the machines. As a result, many feared that this awesome technology would for instance cause increase in unemployment (Charlton 1999). Later, economic recess and the potential of a future IT industry fuelled for instance the British government with hopes for a more prosperous future (Selwyn 2002), and thus computers started to be more common place in schools and homes in the 1980s (Charlton 1999). The decline in female interest seems to have appeared with this wider distribution of computers (Lockheed 1985), or at least the wider distribution of computers made a gender gap more visible.

Parallel to such changes in society and technology, different waves of research focus on women, science and computing can be identified. Spilker and Sørensen (2003) use the metaphor of wave rather than phase

to indicate that the waves are continuously going back and forth with different intensity rather than being definite stages with marked beginnings and ends.

Wave 1: Identification of a problem – women as victims of technology.

In the 1970s computers became more common in office automation, and several studies showed that computers were used to downgrade women's work due to scenarios of women's work as low-skilled and easy to replace by computers. Within such a dystopian perspective it was difficult to see how technology could be changed (Spilker and Sørensen 2003).

Wave 2: Recruitment of women to technology.

In the 1980s, based on a pursuit of women's rightful equality with men, women were attempted attracted to design and development of computer technology, and also as users. Through recruiting women, that is, changing women and making them enter men's turf, this perspective asked women to do all the changing. But this was also done with a hope that women would contribute to making a more woman friendly technology, or a technology more in accordance with women's needs (Gilbert 2001, Hughes 2001, Spilker & Sørensen 2003). The challenge was to reduce or eliminate girls' negative attitudes towards computers (Volman 1997).

Wave 3: Criticise technology (and gender).

In the mid-1980s the focus started to shift towards critically reviewing science and technology it self, and intervention programmes were designed to change the way science and technology were taught and presented in order to make them more accessible and relevant for women (Gilbert 2001, Hughes 2001), for instance by focussing the teaching around girls' everyday life experiences and learning styles (Volman 1997). Further, a broader range of computer applications were introduced in the 1990s along with the wide distribution of computers into almost all spheres of life (Volman and van Eck 2001), causing a possible disentangling of the technology from mathematics and science, and also a widening of possible associations. Particularly the communicative aspects of the Internet have been seen to interest girls just as games have interested boys (Charlton 1999, Gansmo 1998, Håpnes and Rasmussen 1997, Turcato 1998, Vestby 1998). This widening potential of computer applications may be seen as leaving more room for varied relations between gender and technology (Spilker and Sørensen 2003).

Within contemporary gender and ICT studies there have thus been somewhat of a shift in focus from women as absent in computing and suffering from technophobia towards a focus on how the women actually

make use of the technology, and particularly the Internet (Adam 2000). Thus, we may be lead to believe that we have reached, or are just about to reach full equality between men and women. Through reviewing research on young girls and computing, and through critically discussing its assumptions of gender and technology, I will show that despite all the changes we have witnessed, much research still suffer from weak discussions of both gender and technology, and particularly from not considering them as relational. This discussion is of course informed by the benefit of hindsight. Further, both society and technology have changed with according changes in research focus. I nevertheless find such a discussion interesting in order to summarise past experiences and learn from them, and also because this shows that neither society nor technology, or if you want, neither gender nor ICT are fixed categories that can be investigated once and for all.

The three waves described above do somewhat inform the presentation of girls and ICT research below, but the readers will hopefully see the usefulness of the wave metaphor. The three waves of research on women and computing/science above, and the three waves of gender gap research and three waves of intervention programmes presented below do not represent a chronology, nor are the three different sets of waves synchronised. Nevertheless, the waves do hit each other with various impact, and some waves follow more obviously in the wake of others. Also note that whereas Wave 1 focuses mainly on work, Wave 2 focuses more on higher computing education, while Wave 3 can be said to focus on both work, higher education, primary and secondary education and everyday life. The research results presented below do only focus on teen's everyday life and secondary schools since those are the sites where I intend to place my own research focus.

Gender gap research 1: Computing is masculine

Various explanations for the existing gender divide have been sought, but there are few and narrow proofs of any biological sex differences which can explain why computers normally have been associated with men (Hawkins 1985). But pupils, girls as well as boys, who are more masculine in their gender orientation, are more positive towards and gain more from using computers than pupils characterised as feminine (Brosnan 1998).

In addition to gender traits' apparent influence on computer interest, they also influence interest in subjects where computing is taught. Girls' orientation away from computing was thus further strengthened by the initial attempts of teaching about the technology itself and programming, and by allocating computer education within

science and mathematics, which were perceived as masculine domains (Charlton 1999, Makrakis & Sawada 1996).

Since school computers have typically been associated with mathematics and programming, while home computers were associated with violent computer games with male protagonists and competitive content, both home and school computers were perceived as masculine domains, and hence, seen to prevent girls from developing an interest in computing (Bromfield, Clarke and Lynch 2001, Charlton 1999, Hawkins 1985). Since computer use is stereotyped as a male activity, gender "conscious" and aware girls thus refuse to be associated with computing (Newman, Cooper and Ruble 1995).

There is a bulk of such research which contributes to "establishing the problem". The problem in this case is that girls are excluded from the prosperous Information Society due to their gender traits. Thus, the technology is not questioned but is rather seen as an implicit good the girls are "denied" access to. Girls thus need to be convinced that computing is good for them and that it is not dangerous to press the keys. Consequently, girls need to do like the boys do!

Gender gap research 2: Girls have other interests than becoming computer engineers

Arguing "it's good for you" has never been very convincing whether it is peas or computers. Still, both girls and boys see the advantage of using computers in their everyday life, but girls are generally less interested in learning how to use them. This apparent lack of interest may be rather related to anxiety or lack of self-confidence, because girls reported anxiety towards computers and a feeling of helplessness despite proving themselves as competent users (Shashaani 1993).

This lack of confidence despite being competent can be related to the "we can, I can't" paradox which is not unusual to find when young women talk about computers. This means that young girls have a tendency to feel insecure about their own computing abilities, at the same time as they feel that women as a whole are equally competent with men in computing (Makrakis 1993, Reinen and Plomp 1993).

Still, after some hesitation, girls and women tend to be confident, although pragmatic computer users when studies or jobs require the use of ICT (Durndell, Glissov and Siann 1995). Girls want to use ICT in order to make the learning process more independent and interesting. They are motivated by present usefulness, and do not want thorough introduction to something they do not see the benefit of (Håpnes and Rasmussen 1997). This apparent lack of interest in computers may also be due to biases in the research (Stuedahl 1999) or that the research has not managed to fully grasp how the girls define and talk about

computing. Many girls do not perceive their own playful computer use as proper computer use. "Proper computer use" is defined as useful computer use like daddies do at work, and "proper computer users" are anti social boys who have no friends and spend all their time in front of the computer (Gansmo 1998). The "asocial and single-tracked computer nerd" is a figure the girls in secondary schools will not identify with, both because he is asocial and because he is not engaged with the useful aspects of what the computer can do for us. Instead he is, as the girls see him, engaged with computer games and playing around. The girls on the other hand, claim that they find it useful to learn computing for a future career. Many girls thus construct a gender identity through and with the help of "good girl" ideals. To be clever at school, which also includes being clever at computing, is something to strive for. ICT becomes a part of their gender identity construction because this construction happens with a reference to the ideal of the "good girl" and to the modern, competent woman with higher education and a job (Kvaløy 1999). This strive to be a "good girl" goes along with a perception of the computer as a boring but useful tool, a perception that does not trigger the girls' ICT enthusiasm. On the other hand, "not so good girls", that is, girls with lower ambitions for their school work and future career, and girls with more varied and hands-on experience with the computer were more inclined to learn more computing because of a less binding idea of "proper computer use" (Gansmo 1998, see also Nordli 1998).

Thus, many studies show that boys and girls differ in their enthusiasm for computers. Even though both boys and girls may see computers generally as important in society (Livingstone and Bovill 1999), more boys than girls rate computer skills important in *their* future (Holloway, Valentine and Bingham 2000). Consequently, boys are more inclined to study computing while girls are happy with being somewhat pragmatic users of the technology. This seems also to be related to an apparent gendered division of the technology. While boys are more often happy to think about computers as technology *per se,* girls generally talk positively about new computer media only when they have found a way in through an interest in its particular uses, most often communication, but also information gathering and word processing. Thus, a life span of a technology is indicated where the technology becomes more invisible and more thought about in terms of content as the media is domesticated over the years (Livingstone and Bovill 1999) and as more girls become users.

So, the girls do use the computer if they see a use and a need for it. A typical "girls' use" is the *writing room* where they write poems, diaries and stories using the word processor. In addition, girls like to use the Internet to gather information about pop- and film-stars. And they use it

for chatting and e-mailing (Håpnes and Rasmussen 1997). Thus, girls seem to apply computers as a tool in people-to-people interaction leaving the technology of secondary importance, because it is the potential relation to people which creates enthusiasm (Hanor 1998).

Thus, even the women who are reasonably confident at computing are not necessarily drawn towards the discipline of computer engineering. Research should thus differentiate between computer use (which women do feel they master) and computer science (which is dominated by men), because women say "we can, but I don't want to" (Durndell, Glissov and Siann 1995). And it is also important for research to differentiate between types of computer use (Levine and Donitsa-Schmidt 1995).

This second wave of research thus shows that girls seem to have followed the advice of seeing computers as good for them, but in so doing they have apparently developed a feminine use of technology which is not technological enough and which does not recruit more women to the discipline. Even though several studies tried to "empower" the feminine computer use by focussing only on girls and their varied use and comprehensions of computers, these were often interpreted by others as inferior to a masculine technology. Binary gender comprehensions were thus not questioned or problematised, neither was the importance or superiority of the "masculine" field of computer engineering. Girls are thus still seen as in need for a change towards masculine technology values.

Gender gap research 3: Computers are different, but so are girls too

More recent studies have been more inclined to question the technology and thus to conclude that the computer is not one but several media (Drotner 2001), and that the cultural meaning of computers is not yet fixed (Livingstone and Bovill 1999). Thus, *the* computer does not exist for the present generation of pupils because they become acquainted with several kinds of computer applications in their everyday lives (Volman 1997). Computer use differs between homes and schools (Drotner 2001), and it can be used for different and opposing tasks such as entertainment versus education, games versus work and so on (Hagen 2003).

Girls' negative attitudes towards computers and their lack of confidence must thus be seen in light of the complex computer culture. Computer use at school offers only limited room for the playful activities girls find attractive, such as design, drawing, painting, surfing and chatting. At the same time, boys are given many opportunities both at home and in school to play with the computer through computer games. Further, girls' general refusal of the computer and particularly of the

computer games can also be seen as a symbolic downgrading of boys' intense and playful action culture. This downgrading implicitly contributes to upgrading the relational and intimate nattering girls' culture (Drotner 2001), at least among the girls. Kirsten Drotner here indicates that the girls are not victims of technology, but have made an active choice (see also Volman 1997), just as Sally Wyatt (1999, forthcoming) warns that not all non-users are marginalised and want to become users, and as Bernard Whitley (1997) claims that we do not have objective standards for what constitutes the "right" use of technology. Thus, the apparent inherent prosperity and supremacy of ICT is questioned, and researchers seem to focus more on how the teens use and comprehend ICT rather than searching for differences that can explain the absence of girls among computer engineers.

Through focussing on use it is observed that the range of computer applications available are seen to shape gender differences in pupils' attitudes to computers – computers have a variety of potentials, some of which appear to be more attractive to girls, other to boys. But, some studies also highlight competing masculinities and femininities, suggesting that important differences exist within the categories "male" and "female" as well as between them (Holloway, Valentine and Bingham 2000).

Thus, these studies also try to complicate the gender binary by showing that gender constructions are relational and mainly informed by heterosexual relations. For instance did Holloway, Valentine and Bingham (2000) find that several secondary school boys regarded the techno interested boys as feminine and/or gay, which should be taken to indicate that computer technology is not synonymous with a hegemonic masculinity, which is rather associated with physical abilities as playing football. Further, such "football boys" regard game playing as more widespread and much less "feminised" than the techno boys' interest in computers as machines. The girls on the other hand do not see the techno boys as feminine or occupied with an activity suitable for girls. But, as the pupils gain more experience with computers, the girls do not associate the computer as a whole to boys, but different applications to boys and other to girls (Ibid., Stepulevage 2001). Thus, the gender binary is not extensively complicated by such studies, but they do to some extent contribute to "empowering" girls' computer use, or rather, their refusal of letting computers play a significant role in their lives.

Despite most girls being quite competent, they as a group display much less interest in computers than boys do. In contrast to the boys, the girls have no interest in talking about computers, and focus more on "having a life", going to parties etc. They do not represent the traditional "we can, I can't" paradox. Rather, they argue that girls are equally

competent with computers as boys are, and that some girls are better than other girls, but that girls as a whole just are not that interested in talking about or using computers in noninstrumental ways (Holloway, Valentine and Bingham 2000, Stepulevage 2001).

Monique Volman (1997) describes this in terms of different repertoires. Boys more often than girls apply an expert repertoire when talking about computers, while girls mostly apply an outsider repertoire. Instead of posing themselves as experts, girls are more down to earth in their conversations about computers, and they also present themselves as less of an expert than the researcher actually found them to be. Accordingly, boys frequently posed as more of an expert then they were (Ibid., Vestby 1998).

However, most pupils refuse that any general gender differences still exist, claiming that there are no differences between girls and boys. Girls who are interested can do it as well as boys (Lemish, Liebes and Seidmann 2001, Volman 1997). Volman calls this the free choice repertoire, and explains this as lack of repertoire in which gender inequality can be denoted. Both boys and girls use computer freak and secretary repertoires, but they offer no gender-neutral positions. To the boys the free choice repertoire means that they do not discriminate against women, while to the girls it means that they, unlike previous generations, are not passive victims of gender inequality. Further, the outsider repertoire applied by girls implies that they contribute by choice to their own exclusion from the apparently ever more important technological development. Volman further claims that this is not necessarily remedied by computer lessons in schools, because they can serve to extend the boys' expert repertoires where they can brag about new applications they have learned, and it can also extend the girls' outsider repertoires with new "oh, help" stories. Additionally, both repertoires might hamper learning processes and should thus be tried replaced with new repertoires, for instance a user repertoire (Volman 1997).

Thus, we see that this last wave of research has managed to deconstruct ICT and hence also to some extent the binary gender comprehension. Whereas earlier studies directly placed the problem with the girls, this wave is less oriented towards recruiting girls and more towards describing the variety of use. This also implies incentives towards criticising unilateral comprehensions of technology, that technology is not necessarily inherently good and the only way to prosperity for everyone, and thus also attempts at criticising dichotomous understandings of gender.

In line with this, Whitley (1997) concludes that the existing gender gap is small, and asks whether such a gap necessarily is a problem. Is it

necessarily bad that women on average exhibit less computer-related self-efficacy? Further, Whitley claims that we lack an objective standard for what constitutes the "right" score of computer use, and that women's lower self-efficacy might indicate several things, for instance that women have too little self-efficacy, that men overvalue their abilities, or that men and women have different self-evaluations.

Nevertheless, the gender binary seems to haunt us forever. The main problem seems to be that there are perceived to be differences between girls and boys, and that these differences mean that girls are loosing out: The low number of girls and women taking an interest in ICTs gives reason to worry (Bromfield, Clarke and Lynch 2001). Boys have better access to and make more and also more varied use of computers than girls do. Even though the difference is more visible in the private sphere than in the education system, girls are predicted likely to become the new losers in connection to ICT (Rudlang 1995). Gender gap documentation shows that without interventions, males and females demonstrate different computer-related attitudes and behaviours (Canada and Brusca 1991). Thus, several intervention programmes have been initiated and I will describe some of the remedial actions briefly below.

Girls and computing as policy practice

Remedial action 1: Give girls feminine technology

Familiarity with computer games may encourage confidence in more "serious" computing. Albeit this relation is seen as hard to test, Sonia Livingstone and Moira Bovill (1999) suggest that if there were more games for girls, the girls may gain more confidence to start the path towards computer proficiency, and that maybe games should not be banned from school for the same reason. In line with this, others have suggested that in order to attract more girls to use computers, software for girls must be produced (Newman, Cooper and Ruble 1995). Actually, some software designers have devised special "girl software" intended to tap into girls' interests and complement the way girls like to learn. Some attempts were moderately successful while others resulted in software that was less interesting, or that reinforced female stereotypes (Sutton 1991). Rather than making software especially for the girls, it is also suggested to include girls through applying the technology in ways the girls find authentic and realistic (Volman and van Eck 2001).

Thus, in contrast to Wave 1 thinking where technology was seen as fixed, such intervention programmes rather attempt to recruit girls through offering them a feminine technology based on assumptions that girls are a homogeneous group in strong contrast to a homogeneous

group of all boys. These intervention programmes can be described as a mix of efforts to acknowledge women the same rights as men (the right to technology) and efforts to acknowledge that women's values and experiences are different from men's (the right to a different technology). Still, technology is implicitly seen as an inherent good the girls are deprived access to, and hence, the girls need to be rescued. Even if the rescue operation must make a detour via feminine technology, this is intended to eventually give girls access to *the* technology. Thus, these intervention programmes do not challenge the gender dualism at all, but rather reinforce the dualism and hence also a gender-technology hierarchy (see Faulkner 2000), where it is hoped that girls will go from total absence via the lower steps of the hierarchy to the top of the masculine technology. Through changing the technology it is hoped that girls will improve.

Remedial action 2: Improve the girls

One of the most commonly applied inclusion policies among gender aware schools were to train female teachers in computing and to select females as supervisors for other students' computer activities, because many schools emphasised the importance of providing girls with female role models (Reinen and Plomp 1993).

Usually when schools observe gender differences in computer use this is often more related to how the pupils approach the computers than their ability to use them. Girls are not interested in competing with the boys' "mad rush" for computer access. Thus, in class rooms where equal access is ensured, girls need not compete and can rather concentrate on learning and enjoying skills with computers (Watkins and Brimm 1985). Further, girls are seen as clever users but insecure about the technology. Boys are seen as more confident and dominating, and also as pushing the girls out. This is tackled in some schools by getting the children to use the computers in single-sex groups and by teachers actively encouraging girls to participate (Livingstone and Bovill 1999). But, time set aside for girls-only access to computers or instruction was the least used policy (Reinen and Plomp 1993).

Such intervention programmes offering positive action in order to improve girls' skills and confidence are in line with Wave 1 thinking, where women are somewhat victims of the apparently neutral and inherently good technology, but also in accordance with Wave 2 thinking that women should be recruited. This means that through securing access to computers and improving women's skills and confidence, this will make them better fit to adapt to the masculine computer culture. Thus, neither gender dualisms nor technology are questioned or criticised within such a perspective.

Remedial action 3: Just use IT

For many young people it is the school rather than the home which provides the main point of access to ICT since twice as many children in the UK use computers in schools compared to at home. Schools thus appear to act as an "equalising force" (Livingstone and Bovill 1999).

Introduction of Information and computer literacy courses in lower secondary schools in the Netherlands had positive effect on both girls' and boys' cognitive levels, but somehow contributed to increase gender differences on the affective level. ICT use in schools thus seems to play only a moderate role in the area of gender differences since gender awareness in the curriculum did succeed in diminishing the difference in ICT *knowledge* between girls and boys, but it was not able to remove gender differences in *attitudes* (Volman 1997). Similar scepticism towards school as an "equalising force" is also voiced by Hege Nordli (2001) who found that computer enthusiastic girls in secondary schools in Norway mainly learned their skills at home by using a trial-and-error strategy. The role of formal education might thus have been taken over by home learning. The relatively successful reconfiguration of the gendering of computers that may be observed in Norway is thus seemingly only marginally brought about through the education system. The most important factor is the development of multimedia, and especially the diffusion of Internet access (Ibid.).

The potential of home learning is probably good in Norway since access to home computers is high (about 90%) and with no gender differences. Still, girls report that they use the home computer less than the boys do. But, girls who receive computer training in school claim to use the home computer equally much as the boys, while girls without such training in school use the home computer less than boys who have not received training. Further, computer training in school also works to adjust the boys' and girls' expectations of successful computing to become almost equally high, since girls seem to gain higher confidence from this training while boys' overweening confidence probably is reduced. Astrid Sølvberg (2002) thus concludes that computer training has positive effect on girls. But, even if boys and girls use computers in class equally much, the boys more often seem to use the computers in out-of-class time (Holloway, Valentine and Bingham 2000).

Nevertheless, it might seem as Volman's (1997) recommendation of establishing user repertoires for the pupils is efficient since Holloway, Valentine and Bingham (2000) in their study found that one of the schools which had an official emphasis on use rather than teaching of technology, inadvertently achieved smaller gender differences in out-of-

class use of computers as well, which is also consistent with what I will show in article 4 about the Norwegian schools.

The main effort though, should be to integrate ICT into the curriculum (Livingstone and Bovill 1999), and to integrate computing in several subjects since more experience also opens for more *positive* experiences with computers (Jones and Clarke 1995). Such emphasis on use is also what is implicitly recommended by the Norwegian policymakers, at least in the later years, when their main inclusion strategies seem to be to give everyone, with an emphasis on girls, access to computers, preferably through the integration of computing in all subjects and by increasing the amount of computers available (see article 2, this volume).

Still, despite wider diffusion of computers and more computer applications, several intervention programmes and changes in how the teens use and think about computers, the gender and computing problem is apparently nonetheless constantly present in one way or another. Boys and girls use different aspects of the technology, they use it differently, they use it to varying degrees, and they think differently about the relevance and importance of computing. What we see here is that despite several changes, gender is constantly constructed as a dichotomy of boys vs. girls and that gender and computing is constantly constructed in relation to each other, thus creating a dichotomous hierarchy with girls as the losers (see Faulkner 2000). When designing this project I anticipated that such negative co-constructions could be found embedded in the girls and computing policies, which again would cause corresponding co-constructions further down in the school system and among the users, thus leaving little room for girls in their own computing because each group of actors down the line would domesticate the technology and the stories in their own way but dependent on each other.

Co-construction of gender and technology

Rather than accepting that the policymakers' construction of girls and computing is the only valid story which the other actors will adopt, I choose to focus on the content of the girls and computing problem empirically at different sites, and thus I investigate multiple actors involved in socio-technical networks (Lie and Sørensen 1996). As I go back and forth between the different actors and their negotiations, I aim to avoid technological determinism. Hence, I start from the premise that the nature and qualities of the technology are not intrinsic and merely shaped by technological processes. Technologies and their qualities are rather seen as socially constructed, shaped and configured by a variety of actors in social relations. One of the key insights from such a perspective

is the reminder that "things could be otherwise", that the existing technologies are not the inevitable and only result of the application of scientific and technical knowledge (Henwood and Wyatt 2000). Technologies are thus not seen as sealed black boxes, but rather as open to flexible interpretations (Pinch and Bijker 1987). In my case this is taken to indicate that a policy or a technology does not carry an intrinsic, fixed meaning in itself, but rather that the users of this policy or technology add meaning to it, they construct the meanings of the artefact and thus domesticate it (Aune 1998, Silverstone et al. 1989, Silverstone and Hirsch 1992, Sørensen 1996).

To domesticate means to tame or bring the wild under control and to cultivate the tamed (Lie and Sørensen 1996, Silverstone and Hirsch 1992). Domestication was originally introduced to grasp the wide process of how technologies were implemented in the home or private sphere (Lie and Sørensen 1996), but I extend the concept of domestication to also describe how policymakers, school administrators and computer game designers incorporate ideas of girls and computing in their work, in addition to how teens domesticate computing in school and everyday life. In such a domestication process something happens both with the tamed and the tamer, the technology/policy and the user. Precisely this mutuality or reciprocity has been important in the development of domestication (Aune 1992, Berg 1996, Håpnes 1996, Lie and Sørensen 1996, Sørensen 1996), thus leading to a focus on the reciprocal and simultaneous process in the negotiations: The users and the technology negotiate with each other about the interpretations of use and also of meaning. Thus, domestication is a process where technological objects as well as people may change. If we also have eyes for gender in this process of negotiation, we will see that different aspects of the social shaping and social shape of technology will become apparent, and even more, we will learn more about gender by seeing it through the prism of technology (Cockburn and Ormrod 1993). Thus, I will consider technology and the social relations it is embedded in as a seamless web where the elements are combined in networks of meaning and practices (Callon 1986, 1987), and I will pay particular attention to the mutual constructions of gender and technology in this web.

In the review of previous research above, I found that gender was more or less exclusively constructed as a dichotomy of boys vs. girls, and that gender and computing were constantly constructed in relation to each other, thus creating a dichotomous hierarchy with girls as the losers. Hence, these studies seem to regard computing as the only dependent/contingent variable in the analysis. That is, computing is seen to vary depending on the user's sex, age, socio-economic status etc., while these independent variables on the other hand are seen as fixed and

unchangeable. What I propose in this study is rather to see computing and gender as contingent or mutually dependent categories, as co-constructed, in a process where the role of computing as well as the role of gender continues to be negotiated in relation to each other. Thus, both gender and technology are seen as fluid and flexible, and also as constructed, maintained or changed within the same process. The advantage of such a co-construction perspective is that it creates possibilities for political strategies for change (Cockburn and Ormrod 1993). Further, it challenges distinctions between nature/culture and between material/human. Theories of technology are usually seen as liable to two errors: technological determinism, which reduces technology to science and the machine, and sociological reductionism, which reduces technology to social relations (Collier 1994 and Norris 1997, both cited in Clegg 2001). The co-construction perspective on the other hand avoids both pitfalls and opens up to change by seeing both technology and gender as fluid and flexible processes that are not ultimately resolved, they are both negotiated as meanings and shaped in interactions or relations between humans or between humans and non-humans, and both are thus performed rather than given entities (Berg 1996).

But technologies (and gender) are not infinitely flexible or negotiable; they tend to become embedded and stabilised within institutional and social structures, and to influence or even determine subsequent technological choices (Lievrouw 2002). These stabilising processes are known as closure mechanisms where interpretative flexibility is limited and vanishes as an eventual stabilisation of the technology occurs and predominant use and meaning emerge (Pinch and Bijker 1987). Thus, when designing this project I expected that there would be links between the fairytales the different actors would tell, that I would find rather stable and evident co-constructions of girls and computing within and between each group of actors down the line, leaving little room for girls in their domestication of computing.

The different fairytales about girls and computing investigated in this dissertation, or the different sites I have visited, are described in the articles this dissertation consists of. But, in order to give a short preview, and also in order to discuss the possible links between these sites, I will in the following section describe these articles briefly.

Article 1: Forget the hacker? A critical re-appraisal of Norwegian studies of gender and ICT

Almost 20 years ago Marlaine Lockheed (1985) described the hacker symbolism of computers as narrowly masculine, and maintained that computing is a composite of many varying symbols and tasks, which also are used by women. Thus, Sherry Turkle's hacker should not serve as the metaphor for the computer users of the future, because the future cannot survive without women (Ibid.). Nevertheless, the hacker, nerd and geek symbolism is probably what best characterises the bulk of research conducted on the girls and computing problem. In this first article we thus discuss research on girls and computing by focusing on how the hacker stereotype has been used to explore and explain the relationship of gender and ICT, and what has been achieved from using the hacker stereotype as analytical device, suggesting that it is long overdue that we follow Lockheed's request and forget the hacker. But, the article and this dissertation also critically review the justifications for and consequences of claiming that women are important for the computing future. We must not only leave the hacker behind, but also dualist gender stereotypes.

Article 2: Locked in dualisms: Girls and computing as national educational strategy in Norway

Gendered constructions of the computer varies between schools and within schools, and computing is also seen as diverse activities with different connotations. Thus, if policymakers at the national and school level want to promote social inclusion, they need to take into account teachers' classroom practices and pupil cultures when formulating policies (Holloway, Valentine and Bingham 2000). In this I article suggest that Norwegian policymakers have not taken this point seriously. They are not in line with the heterogeneous practises lived out everyday in schools, but are rather trapped by their dualisms, and particularly their understanding of gender as a fixed binary. I even claim that the political girls and computing problem would have been completely different or maybe even non-existing if policymakers had been more open to heterogeneous understandings of gender and the fact that teaching computer use in secondary schools is very different from educating computer engineers, and that the first does not necessarily have to lead to the latter. Due to an aim of recruiting more female computer engineers, the policymakers construct a hierarchy of computing with elementary computing on the bottom, in contrast to constructions of more advanced ICT mastery on the top. This hierarchy is further reinforced through the strong co-construction with gender comprehensions. Since gender is

perceived as a fixed binary and not a continuum, this sets aside the potential flexibility of the technology, and locks it in one feminine and one masculine version of technology use. In this hierarchy, the co-construction of boys and computing make the norm which girls and computing constantly deviates from, thus contributing to an idea that gender equality is achieved through changing the girls. These policy co-constructions are thus oriented around symbols rather than practice, and hence also around dualisms rather than heterogenisation. The limited and delimiting gender inclusive policy, which have the girls' best interests at heart, and which in many ways are consistent with previous research findings, do not necessarily have negative effects on the particular school girls. But it certainly does not do neither girls nor computing any good.

Article 3: Seduced by numbers?

When searching for answers to the girls and computing problem, I found that astonishingly many of the suggestive answers were informed by quantitative research results. Such results are well liked among policymakers, because numbers are easy to read and utilise and because numbers are perceived to represent solid facts in contrast to qualitative research results, which are more perceived as hearsay or common sense, but not necessarily with the same impact as common sense might have. Further, the girls and computing problem is seen to fit hand in glove with quantitative methods which easily can "verify, document, prove" etc. the existence of the gender gap, how wide the gap is, and if there are any changes year by year which in turn can indicate the effects of the policy.

In this article I discuss what kinds of knowledge inform the policymakers in their work on the girls and computing problem, and the limitations of their preference for quantitative research results. The gender gap "is established", maybe somewhat wrongfully due to biased research and statistics (see Stuedahl 1999, Gansmo 1998), causing rather fixed co-constructions of gender and technology, particularly due to the fixed comprehension of gender as a stable binary. Even though the policymakers themselves observe important differences within the categories male and female, they interpret these and the qualitative research reports on heterogeneous gender in terms of gender dualism, thus missing the point of heterogeneity. Further, both dualism in general and in terms of gender comprehensions also inform the policymakers' comprehension of research. Qualitative research is constructed as the little sister of Big Brother quantitative research. The little sister is typically constructed as one female researcher investigating gender equality issues, and producing commonsensical reports almost impossible to apply politically. Big Brother on the other hand is typically seen as a research institute producing facts the policymakers easily can apply in their work. Thus, the policymakers are not only seduced by

numbers: Probably due to their strategy for learning through plan and paper (see Aune and Sørensen 2001), they seem to be trapped by dualisms in general and thus unable to perceive, or at least act on, the diverse relations society seems to be made up of.

Article 4: The limits of state feminism: Chaotic translations of the "girls and computing" problem

Schools are a major site for the reproduction of gendered meanings (Clegg 2001), and schools need a strong administration with a clear focus on applying ICT in the education (Læringssenteret 2003). In this article I thus turn to the administrators of some secondary schools in order to see how they interpret the gender gap issue at their school. Through the eyes of the administrators I describe how they translate the gender inclusion policies from the school authorities. The situations and results described here are thus not the result of my evaluation of the schools, but rather the administrators' evaluation or presentation of their own strategic competence.

My findings are similar to Holloway, Valentine and Bingham (2000) who found that many schools do not have a policy to promote gender equity in computer use. Rather, the administrators argue that they provide access at school for all pupils regardless of social background or gender, and that the teachers cannot be social engineers as well (Ibid.). The policymakers' co-constructions of girls and computing are thus not necessarily adopted by the school administrators. Policymakers and school administrators are not in line, and the schools are rather different from each other as well. The policymakers seem to have succeeded in implementing notions of gender as a fixed binary, because the school administrators accept such categorisations despite reporting more varied comprehensions of gender, and despite questioning both whether the dualism is a problem and whether girls and computing really is a problem. The school administrators are located between the policymakers' symbolic and binary co-constructions on the one hand and the pupils' more practical and heterogeneous co-constructions on the other. Thus, the school administrators do not particularly accept the policymakers' dualistic and hierarchical co-constructions of gender and ICT. They accept that ICT is crucial, but refuse the policymakers' rather stable categorisation of computing. It is further interesting to note that applying a gender equality policy does not guarantee gender equality, and that the absence of such a policy is not incompatible with achieving gender equality as a side effect through other means. Thus, applying a user perspective (see Volman 1997) rather than a gender perspective may open up to new and positive co-constructions of gender and technology.

Article 5: The gender game

Computer games are commonly held to be an important stepping stone towards becoming a skilled computer user. Since computer games are seen as produced by men for men/boys, they are seen to represent one of the most crucial mechanisms that exclude girls from the Information Society. Albeit hard to test, it is thus suggest that if there were more games for girls, they might have more confidence to start the path towards computer proficiency (Livingstone and Bovill 1999). In this article we thus approach Norwegian computer game designers in order to analyse how they perceive their users/customers, and whether they apply any design strategies to include women.

Several of the designers question whether women really do not play games, and claim that if women do not play, this is more due to their lack of time, interest or knowledge than to the content of the existing games. Thus, the scepticism towards designing games for women-only was very outspoken, while most of the designers claimed the fruitfulness of making high quality games which also could be cross-generational and cross-gender games. Their game design was mainly based on the I-methodology with few and only implicit attempts to also include women or girls as gamers. But, if they were to design women-including games, these were thought to be best based on well established feminine traits, interests and activities, and thus contributing to reinforce the gender binary. Thus, the computer game designers do to some extent co-construct girls and computing along the same lines as the policymakers, but they do not necessarily apply these constructions to make positive actions. The computer game designers are to some extent informed by symbolic and binary co-constructions of gender and ICT, but through focussing on implementing feminine qualities in the games they also try to co-construct ICT with transgender qualities.

Article 6: Transforming computers - transgressing gender? A study of young teenagers

Young children are not simply "receiving" the construct of a the computer generated by familial or marketing discourses, they are actively constructing their own definitions of computer technology (Sutherland et al. 2000). In this article I thus investigate the teens' different constructions of the computer, and find that computing is closely linked with activities the children already make time for in their own lives. Like Volman (1997), I thus claim that *the* computer does not exist for the present generation of pupils because they become acquainted with several kinds of computer applications in their everyday lives. Further, these activities are more important than the computing activity per se, and the computer is thus left as an invisible black box:

For instance, the teens "listen to music" and do not mention that they download this music from the Internet.

Further, the teens seem to differentiate sharply between school computing and leisure computing. School computing is seen as gender neutral and boring, while leisure computing is seen as more varied, more interesting, but also somewhat gendered. Still, the teens refuse that any general gender differences exist because "girls who are interested can do it as well as boys" (see also Lemish, Liebes and Seidmann 2001, Volman 1997). The relatively successful reconfiguration of the gendering of computers that may be observed in Norway seems thus to be realised only marginally through the education system (Nordli 2001). The major factor is the leisure activities. Nonetheless, the important aspect here is that the teens co-construct gender and computing rather differently from the policymakers and school administrators creating vast possibilities for different computer applications and users, and thus the teens seem to transgress the traditional gender binary as well. The teens' co-constructions of gender and ICT are at the same time dualistic and heterogeneous, symbolical as well as practical. The co-constructions are more dualistic and symbolical when the teens describe other people's use of ICT, particularly people they do not spend much time with, or who uses other applications of the computer than the teens themselves. Their own practice and experience on the other hand, as well as their network of friends, contribute to more heterogeneous and practical co-constructions which may work to reveal and replace traditional dualist co-constructions of gender and ICT.

Article 7: Out of the boys' room?

In the articles described above we first set the scene by criticising previous research on women and science/computing and then moved on to describe our empirical research at four different sites. In this final article we try to summarise all of the above in our critical discussion of state feminist understandings of gender and ICT, and suggest that we should apply more heterogeneous approaches towards both gender and computing both as researchers, policymakers and "executors of policies". Particularly we argue that the feminism of difference underlying much of the state feminism regarding gender and ICT has contributed to a widespread acceptance of dualist understandings of gender and ICT. Rather, in order to cater for skills and values needed in order to create a productive and pleasant Information Society, ICT has to, so-to-speak, be moved out of the boys' room and into a place more appreciative of the heterogeneous ICT practices carried out everyday by different girls and by different boys and thus leaving the gender dualisms forever behind.

In this overview of the seven articles this dissertation is made up of, we have seen that the co-constructions of gender and ICT varies between the investigated sites. The co-construction processes have been both dualistic and heterogeneous, oriented around symbols and more practical experiences, and related to policy, practical experiences and products and different computer applications. Further, despite the notion of co-constructions as dynamic due to the interplay between the cultural and the material, some of these co-constructions have been rather closed and stable. Particularly the policy co-constructions, which intended to make a change, have been rather stable and dualistic, thus missing the potential for change. In contrast we see that the co-constructions of the intended receivers of these changes, the teens, are heterogeneous and more dynamic, thus leaving us with an impression that there is no "girls and computing" problem.

Are girls and computing such a problematic relation after all?

The aim of this dissertation was to investigate the content of the girls and computing problem as it was constructed at different sites, and also how these stories were related to each other. I wanted to look for implicit notions of gender which could influence (negatively) how teens came to use and appropriate ICT. To make a conclusion then, I note that the co-constructions made at the different sites were less in accordance with each other than I anticipated on the outset, and that researchers, policymakers, school administrators, computer game designers and teens are not on line. Much of the research constructed a dichotomy of boys vs. girls causing a dichotomous hierarchy of computer use with girls as the losers. The policymakers demonstrate rigid co-constructions where gender is seen as a fixed binary related to a rather stable technology, probably related to the policymakers' preference for quantitative research and their understanding of gender equality as 50/50 distribution. Since gender is perceived as a fixed binary rather than a continuum, this contributes to lock the co-construction of gender and ICT in a manner where boys and computing make the norm which girls and computing constantly deviates from. The school administrators are located between such symbolic binary co-constructions and the pupils' more practical and heterogeneous co-constructions, and thus produce more diffuse and varied co-constructions. Since the schools and the school administrators are different, their co-constructions vary accordingly. The school administrators are to some extent jammed between the rather symbolic co-constructions from the policy and the more practical co-constructions displayed by their pupils. They adopt the gender binary, but relate this to

different aspects of the technology. The game designers are not to the same degree caught between policymakers and users. To some extent they adopt the policymakers' fixed binary comprehension of gender, but not their comprehensions of ICT, and thus apply another strategy which implicitly may interest more women to play games. The game design is conducted around symbolic binary co-constructions of gender and ICT, but also informed by attempts at more transgender comprehensions of gender through focussing on the quality of the game. Finally, the teens further complicate the girls and computing problem with their dualistic and heterogeneous as well as symbolic and practical co-constructions of gender and ICT. Thus, the teens demonstrate more open and ambivalent co-constructions, ranging from boring and genderless school technology, via different leisure interests rendering the technology as invisible and rather genderless, to more traditional co-constructions where the teens convey that boys are probably more interested than girls. The teens move effortlessly between transgender user comprehensions and a few binary gender comprehensions. Since the technology is so widely deconstructed by the teens, they do not reach one fixed co-construction of binary gender with one unitary technology, but are rather representatives of dynamic co-construction processes.

Thus, the girls and computing co-constructions from the policymakers were not immutable mobiles or closed interpretations transported unadulterated down the line to other sites. Rather, girls and computing have constantly been unpacked and redefined within and between the sites. There seems to be some interplay between the sites, some stabilisation or closure. But, when we consider the large differences in the co-constructions of girls and computing, this interplay seems surprisingly low. Thus, the diversity of co-constructions found among the groups indicate that it is not the policy which has reached its aim, and that other actors have been active in constructing alternative understandings. What then have caused these co-constructions to be unstable? This dissertation does not provide answers to that, but we can speculate that the technological development is part of the answer. Further, the wider diffusion of ICT into more spheres and ICTs with new possibilities for application also leave little room for stability in the domestication and understanding of ICT. And, part of the answer is probably related to social learning, the ability to gain knowledge from the widely dispersed interactions between different actors in the domestication of the technology. Social learning seems to be most present among the teens, and to a surprisingly low degree among the policymakers, probably related to how they design their learning process. The policymakers seem to apply a learning by plan and paper strategy, where implementation of ICT in schools is planned achieved through

transforming information from quantitative surveys and bureaucratic reports mainly based on statistical information (Aune and Sørensen 2001, and article 3, *Seduced by numbers?* in this volume).

Thus, this dissertation suggests that several changes have occurred since Volman (1997) found that when girls and boys in their early teens are preoccupied with becoming women and men, they are actively constructing their gender identities around the computer due to its association with masculinity. Rather, I found that among the teens in my research the computer is no longer so strongly associated with masculinity, amongst other things because the computer is no longer seen as a technology with a single meaning. Through transforming the technology the teens manage to transform gender constructions as well, or is it the other way around?

What we should learn from these teens then is to question both gender and technology, to view them as fluid and flexible, and as constructed, maintained or changed within processes that are not ultimately resolved. Thus, we need to question whether reaching a 50/50 distribution of boys and girls in front of the computer is the same as saying we have reached full gender equality. Such a claim is likely to be built on at least two flawed presuppositions: Computers represent a unitary technology which is inevitably good for all of us. And further, boys and girls represent two homogeneous but opposing groups which must be equally represented in order to avoid inequality.

Instead, it is important to note that there also are large differences between boys and between girls, and that difference between boys and girls is not the same as inequality or injustice. In order for there to be inequality there have to be both difference and disadvantage (Henwood, Wyatt, Miller and Senker 2000), and in order for there to be disadvantage, computing "the proper way" must be seen as inevitably good. Thus, it is not the difference in itself which is unfair. The difference becomes unjust when either men or women consciously or unconsciously are denied or deprived rights or recognition due to their gender. When some girls are different from boys or choose differently than boys, this is not necessarily results of inequality. When large groups of women are deprived of options or choose systematically different from men, it is of course necessary to ask whether their choices have been informed by established inequality patterns in society. But, it is equally important to question who has made the "right" choice, and why is it right. This is where the girls and computing policy fails twice: By constantly arguing that we need the same amount of girls as boys in front of the computers, it reinforces a view of girls as homogenous and different from boys. Secondly, it only recognises the computing boys do as the right computing, and thus, the policy follows a masculinisation

project in its pursuit for equality. This is also why applying a gender equality policy does not guarantee gender equality, and why the lack of such policy is not incompatible with achieving gender equality through other means, as some of the schools is this case say they have.

I do not intend to conclude this dissertation with a claim that we do not need gender equality policies anymore. Rather, gender awareness needs to be implemented into all aspects of society. Thus, we must beware of a possible paradox of equality policies: If we claim that men and women are equal, we do not need gender equality policies. And, if we claim a need for gender equality policies, we also imply that men and women are different. This is where the teens have a lesson to teach us: To view both gender and technology as fluid and flexible, and also to question the importance and relevance of computing. Because, if real gender equality is to prevail, we need to take seriously the many girls, and boys as well, who have domesticated the technology in so many various ways that differ from the "official" comprehensions of the technology. That is, we must acknowledge their computer use as well. But, we must also beware that these processes probably have not taken us much closer to solving the gender and computing problem in computer engineering. This dissertation can to some extent be seen as a happy ending for the girls and computing problem for secondary school pupils in Norway. But, what this dissertation also demonstrates is that there is not one simple relation between gender and computing, and that gender and ICT are not fixed categories that can be investigated once and for all.

Brief note on method

Even though I now have describe a journey which started with a question that I first explored on the Internet and in the libraries before I conducted my own research and analysis, the research process is never this linear. Even the questions changed as I travelled between the Internet, libraries and informants at different sites. But, in the end, that is, when writing this up, I had to choose which sites were the most interesting to visit, the places that intrigued me most, and thus resulted in the seven articles this volume consists of. Looking back, I also see that this travel has changed me as a person/researcher, and I am not sure whether the changes are results of what I have found or what I found missing along the way. Nevertheless, I found it interesting to note that the changes I went through seem to follow about the same waves as the bulk of research on girls and ICT taken together: My first naive aim was to reveal the mechanisms scaring girls away from the computers. I then decided to search for the best intervention programmes. Both the above mentioned

research aims had the purpose of recruiting more girls to computing, and thus to contribute to a gender neutral computing. They were also based on a notion of effective and informative top-down diffusion of ideas. I then found that girls were actually doing computing, but not necessarily in the "preferred" way. I thus decided to apply a bottom-up strategy, seeking recognition for the ways girls applied computers and forget all about recruitment, because the recruitment idea was top-down and based on recognition of a masculine technology in contrast to a feminine technology. And finally, that is, with the submission of this dissertation, I hope that I am successful in "hitting in all directions" by criticising such dualistic gender perspectives and also their relation to rather fixed technology comprehensions.

How then did I approach the girls and computing problem? As indicated above I found that the girls and computing problem needed to be investigated as multilayered as such and also at different sites. Initially inspired by my desire to "solve" the problem and by an idea of top-down diffusion of intervention programmes, I thus decided to start with White Papers on the girls and computing problem, followed by a focus on policymakers and school administrators as a potential contrast to computer game designers, before I approached the potential receivers of these programmes – the teens.

Next step was to choose method of investigation. Or rather, the choice of method follows automatically from the problem I have chosen for this dissertation. Even if I had been granted resources to conduct my own large scale survey, I would rather have preferred to do qualitative research. As will probably be evident from *Seduced by numbers?,* article 3 in this volume, and from my review of previous research above, the problem of absent girls has been thoroughly "established" by quantitative surveys but also by qualitative research. Since the problem seems just as current, at least in the policy discourse, I claim that qualitative research methods were now needed in order to investigate the content of the problem rather than yet again verify previous findings that there *is* a problem and how wide the gap is. Further, quantitative approaches are most valid when technological artefacts and practices have become stabilised, but are inadequate when we want to investigate how the world may function differently from what simple projecting of existing practices and expectations would indicate (Russel and Williams 2002). Even though I have stated above that I anticipated links between the different co-constructions of girls and computing at the different sites, the aim of this dissertation was not to verify such links, but rather to explore them and their strength. And thus, a quantitative approach was never an option for this research. Open interviews on the other hand, are advantageous when the goal is to discover what already exists, but which

is hard to discover because the researcher has not decided beforehand what she is looking for (Kolrud 1999). I do believe that I would not have discovered for instance the lack of interplay between the sites, that is, the constant unpacking and redefinitions of gender and technology through any quantitative surveys.

The analysis in this volume is thus based on in-depth interviews (Halvorsen 1993, Kalleberg 1982) and analysis of documents such as White Papers and action programmes on schools and ICT. The documents gave access to a "historic development" in the views of gender and computing, whereas the interviews provided me more with a here-and-now picture. Since all interviews were either tape recorded or thoroughly recorded through extensive note-taking and then transcribed, the interviews can be viewed as documents as well, even though these documents are produced differently and with other intentions than the public documents. Further, since there are few established methods for analysing texts within social science (Ryghaug 2003), I have analysed the public documents in the same manner as the interviews. I thus regard both the documents and interview transcripts as witnesses of social conditions, as sources for understanding different forms of social phenomena (Sørensen 1984). Additionally, the documents and the interviews served as a basis for the subsequent interviews, either because they informed my line of questioning, or because they pointed me towards people that would be interesting to interview. My interviews and choice of informants were also informed by "pre-interviews" conducted with carefully selected informants in strategic positions in the field and also the interviews and analysis I had conducted for my master dissertation (see Gansmo 1998).

From late Fall 1999 to Summer 2000 I conducted all interviews with policymakers, school administrators and teens. I have conducted interviews with five policymakers in the Ministry of Education and Research (UFD) concerned with implementing computing in primary and secondary schools in addition to four politicians representing four political parties in the UF committee. I visited seven secondary schools in the middle part of Norway. And I interviewed 12 pupils aged 14-16, seven girls and five boys from one of these schools. In the fall of 2002 I also conducted interviews with seven computer game designers in four companies together with my colleague Hege Nordli. The main part of the analysis is thus based on 32 qualitative interviews with 35 informants.[8]

Even though the research topic was basically the same for all interviews and the document analysis, there are differences both in information provided and how I approached the informants, the

[8] See appendix A for a thorough overview of the data.

expectations I had towards them, and consequently also in how I treated the informants. There are also differences in how the informants treated me as a researcher, which came more from their expectations than how I treated them. Even though they all can be called experts in their field, their expertise varies and also their consciousness about the research topic. Thus, I expected the policymakers to be the top experts of the girls and computing problem, that is, most aware of and informed about the "problem relation", followed respectively by politicians, school administrators, game designers and pupils. It also follows that the former groups are interviewed about their professional views, while the teens are interviewed about their everyday lives. Thus, and also related to age, I have considered the teens the most vulnerable informants. My role as a researcher has thus varied accordingly. In some ways we can say that I have studied both upwards, downwards and somewhat sideways in this project. And no matter how carefully you tread as a researcher, the informants will, at least for the duracy of the interview, be forced to reflect on the topic, and these reflections may change their later choices. I have tried to cater for few or none changes when studying downwards, but been less afraid of being a changemaker when studying upwards or sideways.

The policymakers and politicians who in their work (that is White Papers and administrative focus) state that there is a girls and computing problem, were eventually confronted with my reading of the White Papers and action plans. I also asked them more critical questions, and I was less afraid of asking leading questions. Further, I felt safe to act a bit as an "action researcher" among the policymakers through informing them about recent research findings in the field, since research actually is an important knowledge base in their work. This also came as a result of their expectations towards me: Most of the politicians made it clear that they were the experts and that there was nothing I as a qualitative researcher could add to their knowledge, whereas the policymakers were more interested in gaining knowledge from me.

To some extent I approached the school administrators differently in order to not put words in their mouth or make them uneasy. As will be evident from *The limits of state feminism,* article 4 in this volume, the girls and computing problem is not necessarily felt to be so significant in these schools. The school administrators were asked whether they experienced and addressed any gender and computing problems in their school, and if and how they used and translated the policies from above. But, these interviews were also informed by my wish to give something back to the informants, so I did often end the interview by reporting some recent research findings without trying to indicate that the schools should change their view or approach.

My approach to the computer game designers was more informed by pure curiosity. Not much research is done on how game designers view and approach their audience, or how they try to attract a new audience, so I really wanted to learn from them. And based on their answers, I also felt inclined to give them feedback about different views on the importance of games as a stepping stone towards more "serious" computing, but also the importance of not stereotyping gender in dichotomous roles.

Even though I found it challenging, I really enjoyed interviewing 14-15 years old girls about computing for my master dissertation, so I approached the teens in this research with a great deal of enthusiasm. The quality of the data for this research is at least as high as for my master dissertation, but the content is rather different despite the questions being rather similar. Already in the first teen interview I came to suspect that much had changed in the teens' comprehensions of computers from 1996 to 2000. The computer seems to have become invisible and rather genderless. Even though this deprived me of the lengthy philosophical conversations with the teens that I experienced for my previous project, the information gathered is not any less important, on the contrary. But, this made me even more cautious than before to not leave the teens with any impressions of gender divides or the apparent potential prosperity of computing.

The process of how to go from interview transcripts to an interesting analysis is usually the black box of the research method literature. I do not intend to deconstruct this black box fully here, but since my approach differs a little bit from what is usually accounted for, I will give a short description of how I proceeded.

The process of analysis is of course continuous and starts with the questions I ask and the literature I review before, during and after the data collection. Thus, I do not start from scratch when approaching the overwhelming transcripts. Nevertheless, it is easy to feel overwhelmed by the "amount of words" gained through open interviews. After some "curious resistance and hesitation" towards the transcripts, I very often force myself to the computer and compose an abstract to a soon upcoming conference/workshop. Whereas analysis often is seen to be either theoretically or empirically driven, I like to see my analysis as both, but also equally much as driven by dissemination. This gives me an important and needed deadline to work towards. Sometimes I have of course feared that I have forced my analysis into a premature format, but when reviewing the data I usually come back to the previous conclusions. This is also related to the fact that the analysis starts even with the questions and during the interview. Additionally, receiving feedback from other researchers in the field during the conferences has

later allowed me to take the analysis further, or to emphasise other points than I did initially. I have also gained a lot from combining my dissertation analysis with working on a large European research project - SIGIS: Strategies of inclusion: Gender and the Information Society - where my case reports have been discussed and evaluated by other researchers, and also from close collaboration with colleagues, particularly on the co-authored articles, but also on the others. Such feedback also works to somewhat validate my analysis.

The other point I would like to introduce here is how I actually go from transcripts to analysis. I have developed a method I find most helpful when I am a bit overwhelmed and do not quite know where to go. As most qualitative researchers, I start with reading through the lengthy transcripts and the diary notes on the interview in order to guide me to what I find most striking in that interview. The main topics that come up in this reading, or the main topics I raised in the interview are then used as a guide when I edit the transcripts. Such topics have been for instance: How do they "define" computing, how do they talk about girls/boys, how do they talk about girls/boys *and* computing? After first editing each interview transcript into a shorter version, I collate all informants' answers to each topic in separate topic documents. Each quote is then assigned its subsequent number before I print out "topic one" and carefully cut each quote into a separate piece of paper. On a huge surface, such as the floor or two empty desks, I start solving the challenging jigsaw puzzle. Particularly challenging, but also interesting, since all pieces in this puzzle have equally square shapes, and thus there are no obvious or final correct solution. As I go through all the quotes, I group and re-group them in different formations depending on the topics that come up in this round. The possibilities are endless, but when I read a quote out of its context it is also easier to delete it because it does not "do anything" for me or because I already have a similar quote from someone else. Thus, all interviews have been equally important for the analysis, but not all informants are necessarily represented with quotes. Finally I arrive at a picture I believe will bring me further. Then all quotes are assigned new numbers according to their new order, and I ask the computer to reshuffle the quotes accordingly. I have now arrived at a shorter and more pointed document of quotes which makes the basis for my draft analysis. Thus, the analysis is very much empirically driven, but also informed by theories I have read or come to read later in the course, and equally much by my wish to disseminate my findings to others.

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FORGET THE HACKER? A CRITICAL RE-APPRAISAL OF NORWEGIAN STUDIES OF GENDER AND ICT[1]

Helen Jøsok Gansmo, Vivian A. Lagesen and Knut H. Sørensen

The hacker riddle

Since the early 1980s, there has been sustained scholarly engagement with gender and information and communication technology (ICT) in Norway. Arguably, much of this research communicates with modernist expectations that new technologies should be socially beneficial. These expectations, eminently expressed in the Marxist idea of the progressive development of forces of production, did also influence early Norwegian feminist writings. The most vivid formulation is Mimi Sverdrup Lunden's *The liberated hands'* (*De frigjorte hender*, Lunden 1941), which argued that new technologies had reduced considerably the toil of women in traditional housework.

However, Norwegian studies of gender and ICT in the past 25 years have promoted a gloomier outlook. Lunden's optimism has been replaced by observations that new technologies like ICT have not improved the situation of women. Rather, the introduction of ICT has been seen as supporting the continuation of rather traditional gendered practices, as new technologies have been introduced into and shaped by existing social patterns of differences between men and women (Lie et al. 1988). More recently, some contributors observe in a more optimistic vein that women are becoming included, particularly in the use of modern communication technologies like the Internet and mobile telephony (e.g., Nordli 2001, 2003). The situation is ambiguous, but also dynamic. How may we understand this?

Recently, we did a review of Norwegian research into gender and ICT, with particular emphasis on contributions after 1990 (Berg et al. 2002). A striking feature was the frequent reference to a masculine stereotype first described by Joseph Weizenbaum (1976) as 'the compulsive programmer'. Sherry Turkle (1984) brought the stereotype to fame as the hacker, an asocial male adolescent, deeply involved with computers. This figure invites ambiguity and ambivalence. The hacker's skills are admirable, but he is also seen as socially insecure, spending too much time with computers and too little time with people.

The Norwegian research that we surveyed used labels like nerd, geek and hacker as more or less describing the same phenomenon. We also found references to the 'boy's room competence' (Stuedahl 1997), used to highlight the computer skills (some) boys develop through their

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hobbyist engagement with computers through, for example, game-playing. As Hege Nordli (2003) points out, there are terminological problems here, also because the hacker concept is frequently used to describe illegal activities like cracking codes and entering restricted computer systems. We have nevertheless decided to employ the concept of the hacker as the main label because this is in line with the internationally established use in the social sciences. There seems to be little to be gained from making a distinction between 'hacker', 'nerd' or 'geek', also because they are used interchangeably in the research literature as well as among informants.

What interests us here is not the stereotype as such, but rather the way it has been used to explore and explain the relationship of gender and ICT. The hacker and the idea of a hegemonic 'boy's room competence' related to computers seem to have affected the conduct of research into the issue, the way the problem of gender and ICT is understood among policy-makers, and the way many ICT users and professionals provide accounts of themselves and their relationship with this technology. In this chapter, we want to explore such consequences by drawing upon the material made available through the review (Berg et al. 2002). In this manner, we hope to provide a view of recent Norwegian research in the area while at the same time investigating how the hacker stereotype and the image of the 'boy's room competence' may have acted as a particular analytical focusing device (Rosenberg 1976:108ff) for research as well as an ordering device for actors within the ICT field. Thus, we believe that the work performed by this concept has been consequential to a perplexing degree. Arguably, this 'riddle of the hacker' lies with a particular manner of co-constructing gender and ICT practices as well as academic accounts of these practices. To understand this riddle may also provide an impetus to produce co-constructions that are less dualistic (see Lagesen 2003), transgressing the tendency to think of the hacker stereotype as a negative, alienating but hegemonic standard of doing ICT.

The underlying idea of this sort of inquiry draws upon Anthony Giddens' (1976) concept of the double hermeneutic circle. This refers to the interaction of social science and society, pointing to the fact that while social scientists interpret society, society interprets social science. When social scientists produce concepts to make sense of social phenomena, these concepts may be appropriated in society to change actors' interpretation of themselves and their strategies. In turn, this may transform these interpretations and the way people act, which in the next instance provides altered input to social science research.

Thus, arguably, we need to look critically at what is done within social studies of gender and ICT in Norway with particular emphasis

upon what has been achieved by using the hacker stereotype and the concept of 'boy's room competence' as analytical devices. Not because these devices are misleading, but because they may contribute to the conservation of unfortunate symbolic practices related to the production of misleading gendered dualisms (see, e.g., Faulkner 2000 and Lagesen 2003). In this context, we want to emphasise that all three authors have used the above-mentioned analytical devices in their own research, so this is as much a self-critical assignment as anything else.

We feel this exercise is important also because we believe there has been too little awareness of the possibility that the symbolic interpretation of gender and ICT may have changed over time. Scholarly interest in the problem area took off during the 1980s. At that time, it was primarily an engagement with topics related to women, work and computers. The concern was spurred by worries that new computer technology would affect women's work in a harmful way, especially in the light of predictions of huge reductions of employment (30-40 percent) among clerical workers (Nora and Minc 1980, APEX 1980). Early research efforts demonstrated that the latter predictions were based on problematic assumptions and misrepresentations of what female office workers really did. To observe this, a wider grasp of the relationship of gender to technology, work and skills was developed (Lie and Rasmussen 1983 and 1985). The conclusion was that new office technology created possibilities to improve the quality of working life and enhancing the skills of female office workers. However, most new computer systems were designed with a very limited view of the nature of office work and an uncritical acceptance of the existing hierarchical distribution of tasks. To focus on tasks and the detailed sexual division of labour in many workplaces was also an important feature of the early research efforts (Kaul and Lie 1982, Lie et al. 1988). Inequalities at work were actually found to be produced within working life, from the way work was organised and divided, and in the ways that new technology confirmed such divisions, practically as well as symbolically. These inequalities were neither a result of women's choices nor of the relationship between home and work.

The symbolic backdrop of this research was grounded in notions of patriarchy and of computers as a new object of men's power over women. Thus, the research would identify discriminatory practices – intended as well as unintended – that put women at a disadvantage. This in turn was analysed within a framework of gender politics. However, the concept of discrimination also has important symbolic properties, which we may observe through the way it helps to portray the gender and ICT relationship in terms of oppression and marginalisation of women as well as dissimilarities between men and women. Thus, this

concept has remained a powerful analytical lens in much research about gender differences related to ICT (see, e.g., Volman and van Eck 2001).

In addition, some early research made reference to the way computer science was embedded in mathematics (e.g. Mörtberg 1985). Elin Kvande and Bente Rasmussen (1989) suggested that there would be more female computer science students if this education got closer links to social sciences and the arts, instead of science and engineering. On a more general level, this early research also pointed to the potential problem of the military and masculine imprint upon engineering and the development of technology (see, e.g. the overview in Wajcman 1991).

There has been a shift towards greater emphasis upon cultural dimensions of the gender and ICT problem in the last decade. This may explain an increased concern with symbols and thus a greater interest in focussing devices like the hacker stereotype. Moreover, this interest in symbols is a consequence of a shift in the research agenda. Wendy Faulkner (2001) observes that the concern for women and technology, with an emphasis on gender differences around technology, has partly been by replaced by a concern for gender in technology. This she sees as signifying a growing interest in gender as a factor that actively shapes design as well as use.

At the same time, as noted by Merete Lie (2003), there have also been substantial changes of the role of ICT in society. While the personal computer emerged in the early 1980s, its great breakthrough as a household good came in the 1990s. In the latter period, the use of the PC has been extended. While it used to be a machine for programming, game playing and writing, it has become an instrument for communication and information gathering as well. It is not obvious how these changes, which we label the 'communication turn', may have affected the symbolic interpretation of ICT. However, this chapter will explore the assumption that the increased emphasis on communication should provide alternative focussing devices that produce different accounts of the gender and ICT relationship than the concept of the hacker. This is because the 'communication turn' has coincided with a considerable increase in both men's and women's use of computers.

Is the gender gap closing?

The public debate about gender and ICT in Norway has mainly been concerned with access to computers and the Internet, grounded in the fear of the so-called digital divide. The worries expressed in relation to the concept of the digital divide are related to traditional patterns of social inequalities, including differences between men and women (Frønes 2001). Of course, the digital divide is related to other matters

than just access, particularly skills, but access remains central in the statistical measures provided.

Table 1 confirms a gender gap in access to ICTs, but the most striking feature is perhaps the high level of access to such technologies among women as well as men. When we analyse the numbers more closely, we see that the gender-age interaction is very strong. In particular elderly but also, to a lesser extent, middle-aged women appear to be excluded from access to and use of ICTs. There are no significant differences in access between young men and young women.

Table 1. Access to various forms of ICT at home, according to sex and age, 2000 (per cent).

	Home PC		Internet		Own mobile phone	
	Males	Females	Males	Females	Males	Females
Total	74	69	54	49	77	59
9-15 years	92	92	70	69	42	46
16-24 years	79	75	53	51	90	86
25-44 years	81	80	63	61	86	62
45-66 years	71	61	52	39	77	55
67-79 years	28	9	15	3	69	28

Source: Statistics Norway: Norsk mediebarometer, table 4.

We do find a gender gap in terms of use, but women have increased their engagement with PCs and the Internet considerably. This is evident from table 2. We see that in 2001, 26 per cent of Norwegian women use a home computer on an average day, compared to 40 per cent of men. Men spent an average of 38 minutes on their home computer, while the female average was 16 minutes. Similarly, we see that in 2001, 31 per cent of Norwegian women used the Internet on a typical day, spending an average of 14 minutes, compared to 41 per cent of Norwegian men, who spend on average 27 minutes using the net.

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Table 2. Use of home PCs and the Internet according to sex, 1995-2001 (per cent and minutes).

	1994	1995	1996	1997	1998	1999	2000	2001
Per cent using home PCs								
Males	16	13	17	18	22	27	30	40
Females	6	6	7	8	11	16	20	26
Minutes spent on use of home PCs								
Males	15	12	17	16	18	25	28	38
Females	6	5	5	7	7	12	14	16
Per cent using the Internet								
Males				10	14	23	33	41
Females				3	7	12	21	31
Minutes spent using the Internet								
Males							23	27
Females							11	14

Source: Statistics Norway: Norsk mediebarometer, tables 7 and 8.

When controlling for age, the differences diminish, but they remain significant. Table 3 indicates that the most active users of the Internet as well as mobile phones are young men, but young women are not very far behind.

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Table 3. Daily use of mobile phones and the Internet, according to sex and age, 1999 (per cent).

	Internet		Mobile phone		Internet and mobile phone		Neither Internet nor mobile phone	
	Males	Females	Males	Females	Males	Females	Males	Females
Total	23	12	31	15	11	4	56	76
9-15 years	15	11	14	13	4	4	74	80
16-24 years	35	19	56	42	18	9	27	47
25-44 years	32	17	44	15	15	5	39	73
45-66 years	18	8	20	9	7	0	70	84
67-79 years	2	0	6	5	2	0	94	95

Source: Ling and Vaage 2000.

The mobile phone started out as a tool and an assumed status symbol for wealthy businessmen. Later, there has been greater emphasis on teenagers' access to and use of mobile telephony. Arguably, it was teenagers who discovered the potential of the short messaging service (SMS). As shown in table 4, there has been a particularly swift diffusion process of mobile phones among younger Norwegians. As part of this trend, young girls have caught up quickly. In the early quantitative surveys, boys were more likely to own a mobile phone. Later surveys suggest that girls, and in particular younger girls, were quicker to adopt the device, which is evident from table 4.

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Table 4. Adoption of mobile telephones among Norwegian teenagers, 1997, 1999 and 2001, according to age and sex (per cent).

	1997		1999		2001	
Age	Males	Females	Males	Females	Males	Females
13	3	2	35	43	83	80
14	6	1	59	49	82	87
15	17	6	64	73	82	92
16	21	12	73	79	90	96
17	19	4	67	78	89	98
18	30	13	78	68	92	100
19	43	27	81	83	90	98
20	68	20	88	78	86	100

Source: Ling 2001, table 1.

Teenagers are the most frequent users of SMS, with an average of 4 messages per day. Girls use SMS more than boys, in particular among the age group of 13-17. Also women in their 30s use SMS quite frequently, with an average of about 2 messages per day – compared to about 1 message per day for men in the same age group (Ling 2001). Less is yet known about the actual role of mobiles in youth and adult cultures.

The trend towards a closing of the gender gap in the access to and use of ICTs, as observed in the tables above, suggests a 'de-gendering' of ICT. However, such numbers say little about the actual practices and their symbolic interpretation. While the tables propose that the masculine hacker figure is becoming irrelevant to the culture of ICT, other studies point in a different direction.

Tracing hackers and the 'communicative turn': Technology in everyday life

Margrethe Aune's (1992, 1996) early study of home computers examined the cultural integration of the computer and its significance in users' everyday life. Her female informants had, with few exceptions, nothing to do with the appropriation of the machine and little or no knowledge of computers. They did not use it much either. The computer was just a tool for necessary work of modest extent. Their relationship to the machine was instrumental, similar to some men but not all. Computer enthusiasts were men, but not all men were computer enthusiasts. In Aune's analysis, when women chose to be non-users, this was mainly because they wanted to spend their time on other activities. However, some were unhappy about their partners' computer enthusiasm and the amount of time they spent in front of the screen, and these feelings fuelled distaste for computers.

Aune discovered the hacker phenomenon mainly through her analysis of a sub-culture among young men, which she called Amiga hackers. This reference to a particular computer is due to the outstanding graphical qualities of Amiga computers at that time, compared to ordinary PCs. A striking feature of Aune's description of the Amiga hackers is the very thorough social organisation of the sub-culture, with frequent teamwork and social interaction at so-called copy-parties. Thus, they come across as different from the hacker stereotype presented by Sherry Turkle (1984).

In fact, the few Norwegian studies focussing explicitly upon people that see themselves as hackers raise some doubts about the adequacy of the perceptions that, trailing Turkle, have become widespread. In their analysis of a community of young, male engineering students at the so-called Software Workshop, Tove Håpnes and Knut H. Sørensen (1995, see also Håpnes 1996) observed a rather complex and heterogeneous masculine machine culture. They found the hacker culture to be ambiguous, displaying individualist as well as collectivist traits. There were strong elements of competition, but also of collaboration. Hackers were thrilled by opportunities for play and entertainment but also by work and utility. What have been held to be typical masculine traits, such as hierarchy, competition, distance and control were evident among them. At the same time, traits usually described as feminine could also be found, such as co-operation, reciprocal interchange, care and tolerance. The hackers defined their community as the most important cultural resource in their efforts to become creative and innovative computer users.

This interweaving of different value elements was a result of the space for negotiation that this subculture provided for its members to create meaningful relations between the computer and their masculinities. Håpnes and Sørensen (1995) emphasised the importance of grasping the relational dynamics between technology and its users/designers. A focus on hackers' use of computers also provided an understanding of how hackers, in continuous negotiations with human and non-human elements, constructed personalities and culture as well as technology. Compared to Turkle's (1984) description of MIT hackers, this Norwegian hacker culture appeared less exotic and more heterogeneous. Moreover, it seemed to allow its members to model different masculinities through the acceptance of a wider variety of personal qualities.

Crucially, these studies promote a more social image of the hacker than found in the stereotype. The striking feature of Aune's sub-culture is not asocialness, but rather tight and well-developed social networks. In this respect, it is interesting to note with Hege Nordli (2003) that copy-parties or data-parties have in fact become quite popular, contradicting the image of computer enthusiasts as loners only interested in their machines. However, as we shall see later, these more positive images of computer enthusiasts or hackers have not been able to correct the common perceptions expressed by the stereotype.

This is surprising given the more recent findings that the traditional gendered pattern of computer use has changed, to emphasise that also girls and young women may be interested and enthusiastic users (see Håpnes and Rasmussen 1999, Gansmo 1998, Nordli 2001, 2003). In these studies, we definitely see the 'communication turn' working to get women included as users of ICT. However, this does not mean that women just communicate when they use ICT. For example, Nordli (2003) observes a quite varied spectrum of female computer enthusiasm. Female enthusiasts were not just chatting and gathering information on the net; they made web pages, programmed and were even in some cases engaged with hardware. While there are definitely more boys/men than girls/women enthusiastically engaged with computers, the proportion of female enthusiasts seems to be growing noticeably.

The common assumption that women fear new technologies was also questioned by Anne-Jorunn Berg (1996). She found that women could be just as joyful about artefacts as men. Berg's study of the social experiment of placing MINITEL stations in around 300 households showed that the combination of gender and the MINITEL technology was perceived and practised in many different ways. Gender as well as technology may be flexibly interpreted, argued Berg. The introduction of a new artefact, like the MINITEL, could initiate re-negotiations of the

meaning of gender. The result was not gender equality, but Berg challenged common assumptions about a standardised pattern of male and female use of and relation to new technologies. We may also note that the MINITEL experiment addressed an audience of technologically interested adults, not nerds.

The figures about access to and use of the mobile phone in Norway, shown in tables 3 and 4, counter assumptions that women fear new technologies. In fact, at least among adolescents, the mobile phone is being appropriated rapidly by both women and men into a culture of a high level of communication-based coordination, which emphasises expressive aspects (Ling and Yttri 2002). The expressive dimensions are important to boys as well as girls, even if the former group to a larger extent tends to stress instrumental, technical aspects (Skog 2002). Thus, Berit Skog claims that the gendering of the mobile phone mainly is related to specific features, like design and colour, not to the artefact as such.

These findings are in line with our sense of an increasing ambiguity in the gender and ICT relationship. The mobile phone is an important case in point. Among younger people, as we have seen, there is no longer a gender gap in terms of ownership or access, and the artefact is not coded in Norwegian culture as either masculine or feminine. The pattern of use is clear evidence of the increased interest in communication, but we do not find evidence of a gendered view of skills. There seems to be neither a 'boy's room' nor a 'girl's room' competence attributed to the use of the mobile phone.

The situation with regard to the PC and the Internet is different. Clearly, there has been a large influx of, in particular, young female users in Norway. Still, we find outspoken beliefs among politicians as well as the general public that boys and young men are somehow more skilled than young women. In many accounts, the hacker figure is prominent as the yardstick with which skills, activities and norms are measured. As Håpnes and Rasmussen (1999) show, nerdish features like spending too much time with computer or extensive game playing run against the norms of how girls are supposed to behave (see also Gansmo 1998, 2002b). Nordli (2003) found that even among skilled female computer enthusiasts, some boys were always considered best at the activities perceived as masculine. Moreover, such activities – like programming, hardware tinkering and even game playing – were always considered more important than 'feminine' activities like web design and chatting.

It is in light of such findings that we should recognise the discursive power of the image of the hacker and the 'boy's room' competence, which immediately puts women at a disadvantage. In spite

of the 'communication turn', such gendered symbols and meanings were frequently invoked in politicians', researchers' and the general public's accounts of the way computers and the Internet were used. Here, we see the image of the hacker 'doing work' by instigating a particular co-production of gender and computers. This raises questions about the role of the educational system, to which we now will turn. How do schools and teachers manage the gendered meanings of computing, in a situation where girls and boys are expected to learn to use the technology towards similar ends? Are schools and teachers able to destabilize the hacker figure?

A never-ending story? Girls, ICT, and strategies of inclusion in education

Probably, there is no sub-area of the gender and ICT relationship so thoroughly studied as computers in school. The rationale behind this focus should be obvious, since the public school system for a long time has been a prime instrument of social reform. However, the fact that social scientists are investigating the problem does not necessarily mean that it gets solved. As pointed out by several international reviews of the field, a major challenge has been to get actors to recognise the complexity of the issue (see, e.g., Sutton 1991, Volman and van Eck 2001). Already in the beginning of the 1980s, Marlaine E. Lockheed (1985) found that males use computers more than females for programming and game playing. However, such differences were not present with respect to other computer applications and cognitive effects of computing seemed to be similar for both sexes. Nevertheless, for two decades public debates have followed the path of simple dichotomies, presenting girls as a problem for computer use and education.

This tendency has been particularly outspoken in Norwegian policy. Gender equality in ICT skills has been an important goal for the Norwegian Ministry of Education and Research since they launched the first plan for ICT in education in 1983. The authorities wanted to avoid the emergence of different leagues of ICT competent boys and non-competent girls (Aune and Sørensen 2001, Gansmo 2002b). As Gansmo (2003) points out, there have been important shifts in the definition of the problem as well as in the measures taken to address them. However, the use of clear-cut dualisms and simplified images of gender differences have persisted.

To some extent, this may be due to the way the situation has been described using survey data. Let us briefly consider some of the results. As expected, a main focal point has been the issue of access. In 1990, it was reported that 44% of the students in secondary schools had access to

computers at home, 56% of the boys and 32% of the girls.[2] Five years later, in 1995, 62% of the boys and 52% of the girls in secondary schools had access to a computer at home. Over 50% of these boys claimed that they were the most frequent users in their household. Only 20% of the girls made a similar claim.[3] A recent study found that 95% of the pupils in secondary schools and 92% of the pupils in upper secondary schools have access to a computer at home. More than 80% of the pupils have access to the Internet at home, and both boys and girls spend more than 2 hours each week on the Internet. Boys still say they spend twice as much time as girls in front of computers, on average 8 versus 4 hours each week. Much of this time boys spend playing computer games.[4] In terms of access, then, the gender difference is no longer very important. However, policymakers are still concerned about this issue, probably because they worry that access at school is still a problem (Gansmo 2002b).

It seems a common observation that boys are more interested in computing than girls, but on the other hand, it is also clear that girls do develop an interest for computing (Turcato 1998, Håpnes and Rasmussen 1999, 2003). Girls in these studies, in the age group of 13-16, claim to prefer communicative activities. They also say they want to use ICT in order to make learning more independent and interesting. Further, they state that they are motivated by usefulness and do not want a thorough introduction to something they do not see the benefit of. Girls also say that they are better than boys at teaching each other, and they often feel that boys are trying to impress by namedropping technical ICT concepts (Håpnes and Rasmussen 1999). ICT knowledge has a social function among many teenagers as a topic for conversations, as a marker of belonging and as a status symbol (Vestby 1998).

A study at one secondary school found that 96% of the girls and 94% of the boys felt that the use of ICT made teaching more interesting (Jakobsen and Jensen 1998). Also, it is argued that ICT seems to help pupils to concentrate and make them more motivated and engaged in the learning process (Erstad 1998). 75% of the pupils surveyed in secondary schools report that the teachers rarely or never apply Internet in their teaching. More than 50% of the pupils say they use the Internet at school, mainly to gather information. However, according to the survey data, boys are more frequently asked for assistance with the Internet in class than girls, teachers or computer assistants. Most pupils claim to have gained Internet knowledge mostly on their own. Friends, fathers and siblings have to some extent helped them with their Internet training, but mothers only to a small extent and teachers even less (Skog et al. 1999).

However, we should note that there are important methodological problems when using self-reports about ICT use as well as ICT skills. For example, many girls do not perceive their own computer use as 'proper computer use'. They tend to define 'proper computer use' as something like fathers do at work, while 'proper computer users' are asocial boys who have no friends and spend all their time in front of the computer (Gansmo 1998). The image of the asocial and single-tracked computer nerd is a negation of their understanding of how girls should be (Kvaløy 1999). Instead, girls report that they find it valuable to learn computing for a future career. ICT enters their identity constructions because their identity work is performed drawing on an image of the modern, competent woman who has higher education and a good job, and on the ideal of being a 'good girl' (Ibid.). Paradoxically, this ideal seems to elicit a perception of the computer as a boring but useful tool (Gansmo 1998). The combination of the idea of 'proper computer use' and its relationship to the image of the computer nerd clearly limits girls' freedom to explore computers. Still, many young girls think it is fun to play with the computer, to communicate and explore different programs and what happens when they push the different buttons (Håpnes and Rasmussen 1999, Gansmo 1998, Nordli 1998, Kvaløy 1999). Not all young women are caught as strongly in the wheels of the stereotypes.

Unfortunately, as noted above, this cannot be said about policymakers in the area of gender and ICT. The efforts of the Ministry of Education to provide computer skills through primary and secondary education have been quite general and abstract and based on rather weak policy instruments. The plans state that inclusion initiatives are needed at the school level, but little money or other resources are provided (Aune and Sørensen 2001). Consequently, the outcome has depended on the way that schools and teachers have chosen to respond (see Gansmo 2003). Nevertheless, it seems clear that the inclusion strategies directed at girls have been constrained by a conservative understanding of ICT as well as a rather traditional conceptualisation of gender (Aune and Sørensen 2001, Gansmo 2002b). Policymakers have insisted that computers are a serious matter, to be employed mainly for useful purposes. They have tended to argue that ICT is gender neutral, at the same time as they co-construct gender and ICT in a manner that rank boys' competence above that of girls'. On the one hand, there is little appreciation that ICT could be a basis for play and enthusiasm, so boys are reproached for their lack of seriousness. On the other hand, the competence that some boys presumably develop through play and enthusiasm is seen a yardstick against which everyone else is measured and found wanting (Gansmo 2002a, Gansmo 2002b).

In this way, the computer use by women, which is seen by policymakers as primarily based on activities related to communication and information, is perceived as less adequate. This leads to the idea that equal opportunities will be accomplished only when girls have become just as eager and competent as boys, and in the same fashion. This misconstruction is based on an unfortunate focus on results from surveys that have been particularly concerned with numerical estimates of differences between boys and girls, while overlooking studies that stress differences within the sexes and the importance of seeing both gender and technology as flexible and changeable (Gansmo 2002a). Thus, within educational policy and practice, we may observe how the image of the 'boy's room competence' is working against girls and young women.

Knocking on the door: gender in higher ICT education

In spite of various initiatives to make more girls and young women interested in computer science, this study subject remains male dominated in higher education and in employment. In 2002, female applicants constituted a definite minority, ranging from 10 to 20 per cent among Norwegian universities and colleges.[5] The percentage admitted may have been somewhat higher, but women are a minority among students of computer science and engineering. This is the case in most Western industrialised countries (see, e.g., Wright 1997). In fact, there has been a reduction of female students in higher education computer science from the mid-1980s to the mid-1990s. This development has been seen as puzzling as well as worrying, given the importance frequently attributed to the ICT professions. In many countries, this has spurred a considerable research effort as well as inclusion initiatives (see Sørensen 2002 for an overview).

Also in Norway, several studies of gender and ICT in higher ICT education have been undertaken. A consistent finding is the way female students complain about the culture of the discipline, and how they invoke images like 'nerd' or 'hacker'. Rasmussen and Håpnes (1991) found that the women grumbled about the male 'key-pressers' who were always working in front of their screens, with little interest in anything besides computers. These men and their work ethics were considered by the female students to set the standard of what it meant to be a student of computer science, a standard the women protested against.

In subsequent studies, women students interviewed did identify a masculine culture, where men students were perceived as approaching computers differently and also to have a different pre-knowledge and preference for programming than woman students. The interviewed

female students also referred explicitly to the image of the male, antisocial hacker when they made critical remarks about the culture of computer science (Berg 2000). Similar to what was found among girls in school, the hacker stereotype played an important role in the way female computer science students constructed gender, but it also rendered certain parts of computer science into a problematic subject for them (Stuedahl 1997, Berg 2000, Langsether 2001). Some claimed that the culture and ideas of the hackers, even though they represented a small male minority of the students, signified an implicit expectation among staff and students about how interested and competent a 'real' computer science student should be. Although hackers were admired for their skills, the female students used the hacker stereotype as a metaphor for everything they did not like about computing: a singular technical focus, work addiction, and total absorption in computers. In this manner, the hacker came to be used to symbolise a masculine hegemony in computer science (Berg 2000). Many female students saw computer science mainly as something for nerds or hackers (Stuedahl 1997).

In addition, there are images of the profession that emphasise a lot of stress and long working hours, in short, a career that is hard to combine with having a family life (Berg 2000). Also, the small number of women makes it hard to create networks with other women precisely because they are so few (ibid., Langsether 2001). Moreover, female students are troubled by the way terminology is used, and they react against the way the 'boys' room competence' appeared to be important to succeed as student (Stuedahl 1997, Langsether 2001).

Hilde Corneliussen (2002) observed a mismatch between men and women students' perception of their own practical abilities and their self-presentation in a computer lab class. She argues that individual students' actions and statements are produced within the frame of possibilities of constructing themselves as competent and interested in computer science. These frames are perceived differently by different persons in different contexts. Her conclusion is that the mismatch is produced through the way the hegemonic discourse about computing seems to favour men, even though women as well as men may situate themselves in different ways in relation to this discourse (see also Corneliussen 2003).

The hacker stereotype has also influenced the efforts made to recruit more women to computer science, although not exclusively. The Department of Informatics at the University of Oslo tried several types of measures, including the establishment of 'women's groups' among the students, of which at least 50% were women. These actions did help the female students to cope with the dominant male culture, characterised by male students knowing or pretending to know more about programming

than women did, and by a use of an excluding terminology when talking about computing (Langsether 2001, Stuedahl 1997). On the other hand, female students were reluctant to concede that they needed special efforts because they were women. They wanted to be treated as individual students.

In 1996, the Norwegian University of Science and Technology (NTNU) in Trondheim initiated the 'Women and Computing' project to redress the dropping rate of female applicants to the computer science engineering programme. The project proposed and implemented a variety of actions to recruit more women. The actions included a quota for female students, advertising campaigns, and a new module called 'Know your subject', which was supposed to give the students insight in their possible future job situation and thereby strengthen their motivation to continue to study computer science. The underlying idea was that such a topic would be especially appealing to women (Berg 2002).

The advertising campaigns represent a radical effort to redefine the symbolic content of computer science, criticising and even ridiculing the practice of hackers. It promoted the notion that women have certain qualities, like being good at communicating with people, more holistic in their approaches, more problem-oriented and generally more social. The campaigns emphasised that these qualities in fact made women better suited as computer engineers than narrow-minded, technically absorbed male students (see Lagesen 2003).

The initiative has been deemed a success. However, female students who began after the considerable media attention and advertising campaigns did not feel that their expectations were met. They were dissatisfied with the content of the programme as well as the quality of computer equipment and the capacity offered when they began to study (Berg and Kvaløy 1998). As shown by Vivian A. Lagesen (2003), the campaigns promoted a rather problematic co-construction of gender and ICT. Clearly, the argument was intended to make computer science more attractive to women and to create a space for them to be appreciated as computer engineers. However, the female students were caught in a distinctly dichotomous understanding of gender and computer science where gender was naturalised. This served as a cogent discourse that limited a plurality of female choices within the computer-engineering programme (Berg 2000).

The negative role of the stereotypes of the nerd or the hacker among the female students was not just picked up by the social scientists doing the analysis. In fact, they were appropriated by several actors in the NTNU's 'Women and Computing' initiative and played an important role in the way that problems were defined within the initiative (Berg 2002, see also Teigen 2000). Lagesen's (2003) analysis of the advertising

campaigns is particularly revealing in the way she identifies how good intentions to redefine the gendered meaning of computer science were corrupted by the dualistic interpretation of gender and computing, partly resulting from the way the hacker stereotype was invoked. The resulting dualisms produced an understanding where men as well as technology were linked to the hacker stereotype.

If we allow for greater heterogeneity in the understanding of both gender and ICT, the issues may change. For example, Helene Langsether (2001) found in her analysis of the situation among female students at the Department of Informatics at the University of Oslo that there was an under-exploited potential to recruit more women. Many students knew little about the subject before they started and became positively surprised and interested as soon as they got into it. Those who did continue turned out to do so rather by chance. They had not planned to do a masters degree in computer science, but after a while, they discovered that it might be interesting to do so.

Berg (2000) and Langsether (2001) also found that female students had a positive interest in computing as a technological activity, and in different ways. Many female students admitted that they enjoyed programming, the archetypical hacker recluse. But even if programming as an activity was looked upon as okay and fun, no one chose to major in programming because it was associated with the hacker stereotype and regarded as too boring and repetitive as a future job. Thus, the hacker was also invoked as a negative norm in their career preferences.

In this respect, it may be interesting to compare with inclusion initiatives at US universities like those described by Jane Margolis and Allan Fisher (2002), and Eric S. Roberts et al. (2002). Their point of departure is exactly that computer science is fun and interesting, if one provides sufficient opportunities to experience it. Thus, the initiatives focus particularly on teaching quality, availability of female role models, and the insistence that there is no long-term advantage from having the familiarity with computers that we have called the 'boy's room competence'. The strong focus on the nerd or hacker stereotype in Norwegian research on gender and ICT in higher education may have served to produce too much emphasis on gender symbolism. The hacker figure has been used as the main explanation of why there are so few women students of computer science and as the icon of a study culture that women do not appreciate. In comparison, US research (e.g., Margolis and Fisher 2002) does acknowledge the importance of the nerd-like symbolic properties of computer science, but above all, it emphasizes the need to focus on the practice of actually teaching computer science and how this may be improved.

The reinvention of the hacker: gender in ICT design and the ICT profession

The low number of female computer science students implies few women in the ICT profession and the ICT industry, even if the proportion of women may have been larger in shorter programmes available at some private colleges. However, there is little relevant statistical information and few gender-oriented studies of the ICT profession in Norway. We know that general employment has grown more quickly in this sector than in other industries. In 2000, there were 26 per cent women among the employees of the ICT industry. In telecommunications, the percentage was slightly higher, 34, while it was lower in ICT commerce, 24 per cent.[6] Probably, most of these are not ICT professionals since they do not have relevant higher education.

The importance attributed to ICT and the perceived need to have women as designers of ICT has been linked to the idea that gender was an important factor in the shaping of technological designs. For example, Merete Lie (1985) pointed out that the design of office systems reflected preconceptions of skills related to the users' gender. If users were female, designers tended to perceive their tasks as simple and repetitive. Knut H. Sørensen and Anne-Jorunn Berg (1987) found that Norwegian engineering students willingly categorized technologies in terms of gender. Small, clean artefacts tended to be classified as feminine, while big, greasy, noisy ones were categorised as masculine. This labelling turned out to be closely related to the students' perception of the sexual division of labour. Masculine artefacts were used by men, feminine artefacts were the ones employed by women. With hindsight, it may be interesting to note that the computer was one of the few artefacts that was seen as gender neutral.

The early interest in women, work and computers also led to the emergence of a feminist critique of the methodology of computer systems development. Here, female computer scientists criticised the use of overly rationalist modelling techniques as well as a lack of concern for users (see, e.g., Bjerknes and Bratteteig 1987). To some extent, this criticism spurred the idea that women would do systems design different from men, which in turn was an argument to get more women into computer science.

Nora Levold (2001) has analysed some aspects of this understanding by exploring – more than a decade later – the ambivalence expressed by one of the female computer scientists who took part in this debate. The ambivalence is related to the different expectations that came from 'outsider' feminist social scientists, from their colleagues in a male dominated work environment and from their own scientific

interests. Even if female ICT researchers wanted to utilise a gender perspective in their research, they reacted against the normative demands of the feminist knowledge discourse:

> *The claim that feminist critique of science provides the authentic or only feminist perspective leaves us with a feeling of powerlessness. With such criticism there follows a danger of becoming depressed over the discipline and the state of things, and no incentive to do anything about it* (quoted from Levold 2001:146).

Levold interprets the development of a practice of feminist efforts at systems design accordingly as a kind of negotiation between a 'feminist critique of science' position and what may be accepted from inside the discipline as 'proper' systems design. In this effort, female computer scientists had to create their own space and their own strategies.

The idea that women would do computer science differently from men was explored in a study by Elisabeth Piene (1988). Her findings mainly challenged the use of simplistic stereotypes. For example, her male informants were just as concerned about user-friendliness as the women she interviewed, and there were no observable differences in terms of programming styles or problem-solving strategies. However, Piene found that women tended to choose research problems with a more outspoken social or people dimension, while men to a greater extent emphasized design criteria like efficiency, aesthetics and elegance.

Sørensen (1992) argued more generally for the need to move beyond simple classifications when analysing the relationship between gender and particular technologies. A translation between gender on the one hand and material characteristics on the other is generally impossible, he claimed. Such translations may only be performed in cases where gendered controversies or contrasts performed the classification, as in the case of the sexual division of labour. It is in this manner that the translation is constructed socially and made visible. Thus, Sørensen's study of male and female R & D scientists questioned the possibility of using gender as an essential constant in the analysis of a gendered shaping of new technologies.

Berg (1996), particularly in her study of so-called smart houses, furthers the argument by pointing to the way design is shaped by the I-methodology. Designers of the early smart houses constructed these houses to fit the perceived needs and interests of people like themselves, i.e., other male engineers with a particular interest in technological gadgets. This made the concept of the smart house masculine, not as an essential isomorphism, but rather as an expression of a particular gadget-focussed or nerd-like outlook that happened to be shared by some males.

The smart house was not related to the routine work that takes place inside the home, traditionally considered a task for women.

Hendrik Spilker and Knut H. Sørensen (2000, 2002, 2003) studied the production of a CD-ROM for young women and of a web page for everyone, including women. They show how these multimedia products were designed to make their characteristics match assumed qualities of the hoped-for female users. In one case, the design was made on the basis of the idea that young women would be interested in a product that was quiet, oriented towards knowledge, and simple to use. In another case, the design criteria were trustworthiness, totality and individualisation/heterogeneity. In both cases, the implicit design criteria reflect different constructions of the feminine gender. However, they are also made with explicit reference to the stereotypical image of the nerd or the hacker. The design criteria to make something women-friendly were perceived by the designers of the two products as a contrast to what they believed young male nerds would appreciate.

It should be noted that in the abovementioned efforts of the 1980s to outline a feminist alternative in computer systems design, the point of reference was mainstream practice, which was perceived as masculine mainly because the great majority of its practitioners were men. There was no mentioning of any particular geek-ish masculinity like what was observed by Spilker and Sørensen. However, when Elin Buholm (1998) studied computer engineers and their professional orientations and interests, including their views of programming, her informants referred explicitly to the hacker figure.

There is an ironic quality to the resulting analysis. Buholm investigated the role of non-technological tasks and the gender constructions of various tasks and skills. She found that there were different gendered spaces that computer engineers could occupy. There was a 'women's space'; an area where non-technological tasks like organisational development, psychology and change management dominated. Buholm found that this area was career promoting, so both male and female computer engineers wanted to enter. It was experience from and mastery of these non-technical tasks that could result in promotions. However, the 'men's space' was populated only by men with a great interest in and long experience in programming. They were less concerned about a managerial career and wanted to start their own business based on their enjoyment of programming. In terms of getting promotions, it seemed like the 'men's space' was a dead end.

In general, programming skills appeared to be a highly ambiguous and ambivalent core of professional computing. On the one hand, nearly all of Buholm's informants saw programming as the core competence of computing. On the other, most of them also claimed that they mainly

performed other activities. Programming appeared to be low status. Given the perception of programming as rather narrow, technical work, it was not seen to advance one's career. Moreover, it was interpreted as related to the hacker image. Thus, it was something women and the majority of the men would not be involved with (Buholm 1998).

In this way, we meet again the hacker figure as a kind of normative construction. However, the perception of the hacker appeared to be more ambiguous among the ICT professionals than among women students. Hackers' programming skills were admired. However, their style of work and style of life were denigrated. In this context, the stereotype loses some of its sting. Hackers are no longer perceived as having a dominant influence. Rather, they are considered to make wrong career moves. Thus, they may be admired – with caution. The result is greater heterogeneity in the interpretation of gender as well as ICT, where at least some women are allowed to say that they like to program and some men that they do not.

A similar result is reached in Levold's (2002) investigation of the construction of one male computer scientist's position as man and scientist. Using a theoretical framework that investigates gender by looking at practice, she explores his gendered identity construction as he seems to break the 'traditional' masculine fold. Like hackers, he negotiates the right to play, to be fascinated and have pleasure and enjoyment. However, in contrast to the stereotype, he promotes an image of himself as being serious and responsible as well. In this manner, Levold indicates how some of the paradoxes occurring when using gender as an analytical category in research, may be overcome by breaking with dualist interpretations.

Buholm's and Levold's findings indicate that the culture epitomized by the hacker figure is being challenged within the ICT profession. Clearly, in relation to status and career, it is marginalized. However, as a metaphor for playfulness and technological prowess, it is appreciated. Thus, our previous observations about the dominant position of this culture appear as puzzling. What is it about hackers that make them reappear in considerations about ICT and computer science over and over again?

The relevance of this question is revealed through research on the notions that schoolgirls have about the ICT profession and ICT professionals. According to Håpnes and Rasmussen (1999), young female pupils in secondary schools perceived the profession as predominantly technical. ICT professionals were expected to be very interested in and have a great deal of knowledge about computer engineering, understood in a rather narrow fashion. Furthermore, they would sit behind a computer all day and 'talk' through the keyboard more

than to other people. The schoolgirls believed that the main activity was programming, and that ICT jobs were stressful and lonely because the ICT specialists had to focus singularly on machines. Their image of the ICT professionals resembled very much the common image of 'hackers' or 'computer nerds', and this has been identified as the main obstacle for young women to choose an ICT education later (Gansmo 1998, Nordli 1998, Kvaløy 1999, Håpnes and Rasmussen 1998).

Again, we may see this as an expression of the image problem of the ICT profession, created through the prevalence of the hacker stereotype as the icon of working with computers. This image problem was also experienced by female computer enthusiasts who found it difficult to combine their computer interest with being appreciated as a girl (Nordli 2003). Given the fact that many girls and young women are quite heavy users of ICT, we should expect the hacker stereotype to be eroded or at least transgressed. Is there any way out of the boy's room?

The trivialised hacker: from policy problem to industrial standard?

This analysis of Norwegian research on gender and ICT has shown that the stereotype of the asocial, narrow-minded male computer hacker plays a pervasive role in symbolic understandings of ICT among pupils, ICT students, policymakers and even ICT professionals and social scientists. Arguably, we have observed that the hacker figure seems to play a role of The Other, what-we-do-not-want-to-be, in the ICT discourse. While there is some envy of the hacker's skills, his style of life and way of working are usually rejected vigorously, especially among women.

Enthusiasm is an aspect of men's relationship towards technology that has generally been overlooked in research literature (Kleif and Faulkner 2003). In relation to ICT and gender, computer enthusiasm appears as a problematic phenomenon owing to the fact that it is considered alien – perhaps even repulsive – by many women due to the symbolic interpretation of computer enthusiasm as computer obsession. Arguably, social science research on the topic has helped to support and diffuse this symbolic identity between enthusiasm, a good thing, and obsession, a bad thing.

Nordli (2003) has explored in what ways women have fun with computers. Seemingly, a growing minority of women in the computer enthusiast community transgresses the presumptions of feminine instrumentality. They play with the communication potential of ICTs but also engage in programming, web design and even hardware. However, there is a long way to go to change the symbolic relationship between masculinity and computer enthusiasm. Female enthusiasts claim that that

their computer enthusiasm is perceived as suspect. Girls and women are supposed to have an instrumental relationship with computers, not to have fun with them. As a result, female enthusiasts seem to have a rather strained relationship with other women because they have to suppress their enthusiasm in order to satisfy the requirements of being 'real women' (Nordli 2003).

In one sense, these enthusiasts have entered the 'boy's room' and are thrilled about it. However, as Nordli shows, they still have to negotiate the 'boy's room' standard, and they frequently experience that they have to struggle more than boys to show that they keep up with this yardstick. To enter the 'boy's room' appears to be double-edged. It is fascinating, but also painful and limiting. Is there a way out of this dilemma?

As noted earlier, policymakers engaged in the issue of gender and ICT do not offer much help here, since they tend to be ambivalent towards what they perceive as current practices in the ICT culture. On the one hand, they look at the skills acquired by male computer enthusiasts as admirable and as setting the standards. On the other hand, they are put off by what they perceive as an unhealthy obsession by computers in themselves (Gansmo 2002b). The latter observation tends to lead to arguments in support of reforming the ICT culture, to undermine the impact of the 'boy's room' performance. When women choose not to study computer science or become enthusiastic users of computers, this is perceived as a rational choice given the nerdy, anti-feminine qualities of the culture. Thus, it is not women that should change, but the culture of computing (Berg 2002, see also Lagesen 2003). From this point of view, there is no need for women to enter the 'boy's room'. Rather, the room should be shut down.

While one may be sympathetic towards the general thrust of this policy-oriented argument, at least the intention, there are some serious deficiencies. First, it tends to reproduce traditional dichotomous understandings of gender, especially women as people focussed and men as technology focussed. One consequence is that, symbolically, women's freedom to choose is limited by the underlying construction of the dominant characteristic of femininity (see Nordli 2003). If you love your computer, you cannot be a 'real woman'.

Second, it tends to overlook the fact that technology and gender is co-constructed in a dynamic fashion. It may well be that the culture of ICT needs to be changed, but that goes for the construction of femininities and masculinities as well. When more women are included as professional and/or enthusiastic ICT persons, this will have consequences for their identity and their way of relating to technology. It will probably also spur changes in the way men form their identities and

computer-related practices, and in the way professional use of ICT is perceived by the outside world. To use an understanding of gender as something pre-given and constant is a serious error, not just because the understanding is wrong. It is a mistake above all because it provides a kind of lock-in between particular definitions of gender and particular computer practices. It may for example cast women into a narrower professional role because it supports the symbolic interpretations of programming as masculine (Berg 2000).

Probably, the idea that gender equality in the ICT area presupposes reform of the ICT culture is difficult to implement. As Levold (2001) suggests, it may be too demanding for women in ICT to perceive themselves as conscious and efficient agents of cultural change at the same time as they struggle to be recognised as computer professionals. Moreover, it may not be helpful to cast ICT work in the image of skills traditionally perceived as feminine, like communication and empathy. If the experience of being a computer scientist is supposed to be more or less the same as being a social scientist or a nurse, why study computer science in the first place?

One way of understanding the hacker figure as encountered in Norwegian research, is as a focussing device for research on gender and ICT as well as an ordering device for men and women working with or using ICT. In this way, the image is doing work to direct scholarship as well as shaping the gendered practices related to ICT. From this perspective, we have observed several important consequences:

- The hacker stereotype is used to symbolise a masculine hegemony in computer science and as a symbol that links the identity of computers with a particular version of masculinity. Moreover, it is used to highlight specificities of femininity through differences. Thus, the stereotype works to keep women out.
- The hacker figure is also employed to highlight the dangers of an obsessive relationship to computers. Thus, it forms the basis of a call for a more moderate association. In this manner, the stereotype is used as a marker to distinguish between 'healthy' and 'unhealthy' use of computers.
- Related to the second point, we have also observed how the hacker stereotype is invoked as an argument to reform the culture of ICT. The content of this reform has been shaped by the underlying dualist interpretation that allows only two positions, that of the hackers and that of women. Thus, the choice of path of development is not just restricted; it is obvious. To be a hacker is to be unable to resolve real-world problems. Thus, from this dualistic reform perspective, computer science has to go the way of women and to be reshaped in a feminine image.

However, some caution needs to be exercised here to avoid problematic generalisations, because the hacker stereotype is not used in this fashion in all industrialised countries. For example, reviews of Italian (Fortunati and Manganelli 2002) and Irish (MacKeogh and Preston 2002) research do not find these extensive references to the hacker stereotype as we have observed in Norway. Understanding these differences may provide a key to unpacking the stereotype.

The popularity of the hacker stereotype in the Norwegian context cannot just be attributed to social science efforts, even if social science scholarship has contributed to making the hacker figure visible and thus contributing to the double hermeneutic (Giddens 1976) that has been observed throughout the chapter. Rather, the stereotype must in some ways resonate with some aspects of Norwegian culture and changes in relation to technology. The modernist image of the engineer in Norway is as an important and useful figure that contributes in an important way to social progress (Fosli 1996). The hacker stereotype represents the introduction of a more ambiguous relationship towards technology. We admire the skills and the stamina, but we are scared by the obsession and the lack of concern for people. In this way, the hacker stereotype may be read as a symbol of autonomous technology, of technology potentially out of control.

Arguably, the Norwegian culture displays a deep ambivalence towards enthusiasm and pleasure. The prevailing protestant ethos hails constraint, control and moderateness. This allows us to perceive the gendered features of the hacker stereotype in a different light. Drawing on more general cultural images, we know that 'Man' may represent outgoing, colonising, potentially destructive forces, while 'Woman' stands for care and moderation. The hacker stereotype with its clear reference to masculine pleasure signifies too many things considered culturally dangerous. Thus, to avoid anxiety and remain safely within the protestant ethos, feminine destabilization or destruction of the hacker concept is called for. This was what the advertising campaign of the Women and Computing initiative tried to do by combining a ridicule of hackers with an acclaim of traditional feminine qualities (Lagesen 2003).

Of course, the actual situation is more complicated. Within the ICT industry, there has been a revival of the hacker stereotype in relation to the so-called open source movement (Himanen 2001). In this context, hackers represent a progressive move, apparently the only alternative to the continued dominance of large multinationals like Microsoft. Also, an increased influx of female computer enthusiasts celebrating the hacker ethos further complicates our tasks. Is destabilisation simply not possible?

Or maybe destabilisation already has been performed. To some extent, the celebration of the hacker stereotype and the idea of the 'boy's room competence' presupposes that computer skills are something particular, something to be admired because it is strange and not understood. When PCs and the Internet become standard household goods, these skills are trivialised. 'Everyone' knows about computers, how to surf the net, etc., so why the fuss? Thus, the 'boy's room competence' is probably on its way to being reduced to exactly what it is, hobbyist skills that are advanced only in the hobbyist context, similar to the expertise to be gained from playing with electrical toy trains or tinkering with engines or ham radios.

In fact, if we look at the celebration of the hacker stereotype in the open source movement, we discover a stereotype that has changed. Individual skills and single-minded absorption are no longer commemorated, but rather values like freedom and international collaboration (Himmanen 2001, Castells 2001). And what is represented by the open source movement if not communication and community building?

Thus, we should suppress or forget the hacker stereotype while learning a couple of lessons. The first is that invoking a stereotype brings a danger that it produces other stereotypes as well. Given the strong tendency towards dualist thinking in relation to gender, to produce one stereotype related to one gender may just lead to the production of only one other stereotype that so-to-speak fixes the other gender. The second is that there is nothing innocent about the production of stereotypes. If we are successful, suddenly the stereotype may live a life on its own in society, performing operations we did not think about.

Forgetting the hacker stereotype should also be considered as an invitation to repress dualisms when thinking about gender and ICT. The next step is definitely to look for greater variation and more heterogeneity in the analysis of such phenomena. This does not mean that we should forget about the issues related to the exclusion of women in, for example, the ICT professions. We just have to conceptualise the challenges as heterogeneous rather than dichotomous.

Notes

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2 Stortingsmelding nr. 24 (1993-94) *Om informasjonsteknologi i utdanningen* (About information technology in education).

3 *Bruk av EDB i skolen 1995* (Use of computers in school 1995)*,* research conducted by Statistics Norway on behalf of the Ministry of Church, Education and Research.

4 IKT i utdanningen 2002 (ICT in education 2002), research conducted by Datakortet on behalf of the Ministry of Education and Research, based partly on the *European Computer Driver License*.

5 http://www.samordnaopptak.no/statistikk/

6 *IKT-barometer 2000*, Oslo: Statistics Norway.

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LOCKED IN DUALISMS: GIRLS AND COMPUTING AS NATIONAL EDUCATIONAL STRATEGY IN NORWAY

For more than 20 years Norwegian policymakers have agreed on the importance of implementing ICT in schools due to computer skills being regarded as an important resource in the labour market and in society in general. Simultaneously they have agreed on the importance of avoiding a development nurturing new digital access and competence divides due to gender or social status. Thus, it has been seen as important to focus especially on girls and women since they have been observed to be less engaged than men in computing. In general, public schools are seen as "the great equaliser" in Norwegian politics. Accordingly, the system of education is expected to make everyone familiar with the computer (Aune and Sørensen 2001).

This focus has produced considerable amounts of research projects[1] and also a long line of White Papers and action plans on implementation of ICT in schools. The first White Papers focusing on computing in Norwegian schools can be described as taking the wary first steps of introducing computing to a few in order to eventually include everybody as computer users. To be on the safe side, girls were explicitly included in "everybody" due to observed tendencies of males dominating the computers.

The first separate White Paper on computing in schools came in 1983 and talked about electronic data processing (EDP) and programming. Schools should provide teaching in EDP, in addition to other subjects.[2]

10 years later EDP was old-fashioned and replaced by Information Technology (IT). The 1993 White Paper suggested that computing should be integrated in several subjects and not treated as a separate subject.[3] By 1996, communication was included in the concept of information technology. Information and communication technology (ICT) should be seen as a natural part of all subjects. ICT should not be

[1] For a critical review of such research, see Gansmo, H. J., V. A. Lagesen and K. H. Sørensen (2003). "Forget the hacker? A critical re-appraisal of Norwegian studies of gender and ICT" In Lie, M. Ed.: *He, She and IT revisited.* Gyldendal Akademisk.

[2] St.meld. nr. 39 (1983-84) *Datateknologi i skolen*, Kirke- og undervisningsdepartementet.

[3] St.meld. nr. 24 (1993-94) *Om informasjonsteknologi i utdanningen*, KUF.

taught separately, but through applying it in other subjects. ICT should also be used to improve the teaching/learning of the other subjects.[4]

Despite the acknowledgement of a rapidly developing technology, girls' reluctance towards computing was considered quite stable over the same period. Thus, we might say that the absence of girls has been regarded as a problem just as long as computing has been regarded the key to a prosperous future.[5]

Through analysing White Papers on computing in schools over the last 25 years I will in this article discuss what kind of rhetoric these texts display on gender and ICT in order to see how the problem of girls and computing is defined and possibly changed. Particularly I will focus on the co-constructions of gender and ICT, and how these have changed over the 25 year period. Texts are of course flexibly interpretable. In order to understand the reasoning behind theses texts better, and to check my reading of the White Papers, I also conducted interviews with policymakers.

Construction of comprehension

The period in focus has theoretically been influenced by three different waves of studies of gender and ICT (Spilker and Sørensen 2003). Researchers in the initial period from around 1980 argued that computers were used to degrade typical female professions such as office work (Cockburn 1985, Lie and Rasmussen 1983). Such a perspective, focussing on the consequences of the technology, did not offer insight into how technologies could be changed. Thus, a second wave of gender and ICT studies emerged focussing on the lack of computer interest displayed by young girls and the lack of women participating in the design and development of computer technology (Gansmo 1998 and 2003, Rasmussen and Håpnes 1991 and 1997). Several of such second wave studies focussed on the nerd and hacker for setting the perceived standard for what it means to be interested in computing (see Lockheed 1985 for a warning and Gansmo, Lagesen and Sørensen 2003 for a critical review.) Further, as pointed out by Judy Wajcman (1991), several second-wave studies were influenced by predominantly essencialistic understandings of both gender and technology.

Thus, a third wave of gender and ICT studies emerged in the 1990s partly fuelled by the communicative turn of IT. Further, Donna Haraway's (1991) cyborg is an important back-drop to this third-wave

4 *IT i norsk utdanning. Plan for 1996-99,* Kirke-, utdannings- og forskningsdepartementet.

5 St.meld. nr. 24 (1993-94) *Om informasjonsteknologi i utdanningen*, KUF.

through its critical points about the growing problem of distinguishing between what is human and what is technology.

This analysis is thus inspired by third-wave constructivist gender and technology studies, which underline the continuous construction of and the mutual dependency between technology and humans (Bijker, Hughes and Pinch 1987, Lie and Sørensen 1996, McKenzie and Wajcman 1985). Technology and society are here seen as mutually shaped, which also means that technology and gender are co-constructed. It is important to stress that it does not suffice to "add gender in the mixture of technology and stir well" (Lohan 2000). Just as we cannot understand technology without reference to gender, we cannot understand gender without reference to technology (Faulkner 2001), because they are intertwined in what we can perceive as a seamless sociotechnical web (Hughes 1987), where the elements are combined in networks of meanings and practices (Callon 1986, Latour 1987).

When gender and technology are understood as co-constructed or mutually shaped, we can avoid the problems of essencialistic perceptions of both gender and technology, because both gender and technology are seen as parts of processes, not as given and unchangeable (Faulkner 2001). This allows us to perceive the technology as flexible, that is, the technology can be perceived differently among different users or in different contexts (Berg 1994a). Such a perspective also opens for the possibilities of domesticating the technology (Silverstone et al 1991, 1992), and that both technology and users, and thus also the understanding of gender, can change in this process (Aune 1992, Berg and Håpnes 1992, Berg and Lie 1995, Håpnes and Sørensen 1995, Lohan 2000). This is beautifully illustrated by Anne-Jorunn Berg's (1994b) study of the smart-house and Cynthia Cockburn and Susan Ormrod's study of how gender and the microwave (cooking) change in all processes from design to use and also within these stages (Ormrod 1994).

When technology and gender are seen as integrated processes of construction, or as co-constructed where the one is produced through the other and vice versa (ibid., Berg 1996, Lie 1998, Lie and Sørensen 1996), this leads to possibilities for changes in our perceptions of both gender and technology and the relation between these two. Both gender and technology may be seen as changeable, flexible and complex (Berg and Lie 1995). Such a perspective also opens up to possibilities of political strategies for change (Ormrod 1994). Still, as Wendy Faulkner (2000) points out, dualisms related to gender and technology endure despite multiple tensions around them. Further, Faulkner notes that these dualisms readily are mapped onto hierarchies where for instance the technical is valued over the social, and that this work to confirm

technology as a masculine domain. Faulkner, asking why such dualisms endure, offers no simple answers, but suggests that the question may usefully be approached in terms of the co-production of gender and technology.

The focus of this article is thus directed towards political co-constructions of comprehensions of ICT in relation to comprehensions of gender; how do White Papers and policymakers, in writing and in oral communication, construct computing in relation to the youths who are supposed to learn to make use of it in secondary schools? Following the arguments of the theoretical points, I stress that this does not indicate in anyway how girls are, or what ICT really is, but only how they emerge through the co-constructions the policymakers and the White Papers make of gender and technology.

Method

In order to get a bigger picture of the policy comprehensions of gender and ICT, and also in an attempt to understand the reasoning behind these comprehensions better, I choose to supplement the document analysis of White Papers with qualitative interviews with a group of policymakers. The two sets of data are definitely complementary and equally important, but not necessarily comparable. In general, texts seem to be more closed and specifically structured whereas speech can be more open and also influenced by the interviewer. That also means that the co-constructions presented in the interviews probably are made more freely and also based more on private experience and opinions than the co-constructions in the White Papers. Still, both documents and interview transcripts are flexibly interpretable, and thus a combination of these two sets of data is likely to produce a more coherent picture. Yet, the chosen documents represent a time span of about 25 years, whereas the interviews, conducted in the summer of 2000, represent more of a deconstructed "here and now" picture; A picture expectedly more in line with the latest White Papers since the constructions of gender and ICT are likely to have changed over this period.

The combination of these two sets of data was very fruitful. Whereas the documents are made to speak with one rather unison voice, even though they probably are co-written by several policymakers, the interviews are more complex, both individually and together, and thus offer additional information and more radical co-constructions.

The analysis presented in this article is based on official documents and White Papers from the Norwegian government and their programmes on ICT in education covering the period from 1978 to 2003. Additionally, I have conducted qualitative interviews with five

Norwegian policymakers in the Ministry of Education and Research (UFD)[6] concerned with implementing computing in primary and secondary schools, and four politicians representing four different political parties in the Committee of Education and Research (UF committee). The four politicians interviewed represented The Christian Democrats, Labour, The Progress Party and The Socialist Left Party. The civil servants in UFD represented the Division for information systems in the Administrative department, the Department of primary and secondary schools and the Equal opportunities secretariat. All persons interviewed are for simplification reasons called policymakers, except in the quotations where I separate between civil servants and politicians.

The policymakers were primarily chosen based on recommendations from a civil servant at the National Learning Centre and secondly based on recommendations from the persons interviewed; so-called snowballing-sampling (Bijker 1995). During the interviews we talked about the decision makers' ideas about implementing computers in secondary schools and the fact that girls have been regarded as not as competent and eager as boys in front of the computer. Additionally we talked about the policymakers' knowledge base on the issue, where they gathered their information from and what kind of research they used to form their decisions.

The White Papers were chosen after searching databases for keywords such as gender, gender equality, education and different words for computing and information technology. This terminology is not used consistently throughout the White Papers nor in the interviews, and thus neither in the analysis. The White Papers were searched for information on why inclusion strategies of girls were necessary and the kind of strategies that were suggested. I have systematically searched all documents that seemed relevant based on the keyword list. But, not all documents are represented in this analysis. The selection reflects that not all documents on computing in education dwelled on gender equality issues (even though most did) and that several of the documents did not bring up any new issues.

[6] The current Ministry of Education and Research has changed organisation and name several times during the time span of this case. For simplification reasons and since the education part of the Ministry has been stable over the same period, I choose to use the acronym UFD or the Ministry of Education through out this case.

Historical development of gender and technology comprehensions in Norwegian education policy

Changing comprehensions of computing

In 1978, a report on decentralised and effective public computing stated that there was not much room for teaching computer skills in primary and secondary schools due to the amount of other, more important subjects. Pupils in year eight and nine could however choose computing as an elective in schools where this was an option. Further, this document observed that computing education in primary and secondary schools so far had only been sporadic experiments by enthusiastic teachers.[7] Two years later, in 1980, trials were suggested to be initiated in order to integrate parts of computing education in the compulsory subjects mathematics, science and social science in some secondary schools.[8] Thus, initially computers were not common in the standard education system. Computing was regarded as something on the far side of school, something peculiar, and thus just an extra option for particularly interested pupils and teachers. Due to growing attention towards the importance of computing, it was seen as natural to allow more room for computing in school. Considering the fact that the lack of women in computer science has been explained partly through arguing the negative effects of embedding computing in mathematics and military interests (Hacker 1989, 1990, Hawkins 1985), it is interesting to note that this "room for computing" was made through associating computing with science rather than every day life tasks.

In 1983, a co-ordinated and goal-oriented programme focussing on computing in schools was initiated. Here, we find the first political evaluations of important questions regarding implementation of computing in schools. This plan did not aim to implement computing in all schools, but to carry out important and necessary experiments in some schools to make a basis for later implementation in all schools. The plan document stated that:

> *The technological development is so quick and has so strong implications for society, that the danger for a development of new social differences due to differences in the amount of knowledge is considerable. These are divisions that can arise between different*

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[7] NOU 1978:48 *Offentlig databehandling. Desentralisering og effektivisering*, Forbruker- og administrasjonsdepartementet.

[8] St. prp. Nr. 122 (1980-81) *Handlingsplan for likestilling, med særlig vekt på å bedre kvinnenens stilling i utdanning og arbeidsmarked,* Forbruker- og administrasjonsdepartementet.

> *age-groups, different sexes and different social groups…. In accordance with the schools' social function, the education in the school system must aim to even out such differences.*[9]

The plan is rather influenced by technological determinism, or maybe even technological fatalism, claiming the technology implicitly to be unavoidable and unchangeable but inherently bad for social relations. At the same time, a social determinism is present urging the school system to even out the social differences caused by differences in technological knowledge by providing everyone with technological knowledge.

The document stated that it was important that the schools made sure that the differences between those who did gain knowledge of and inspiration for computing at home and those who did not, were as small as possible. This should be achieved by making sure that schools have enough adequate equipment. Thus, access is seen to secure technological knowledge, which is highly regarded, and thus access to the technology is as vital as access to books because: *"Situations where the computer-literate take care of the technical equipment while the majority make an admiring half-circle around them, cannot be accepted."* [10]

In general, the plan document of 1983 noted that computers had become continuously more user-friendly. Thus, it was no longer necessary to possess solid knowledge of electronics to apply the machine or to understand how it works. This meant that it had become easier to demystify the computer. Keyboard knowledge was seen as becoming more important in this demystification. Lack of keyboard confidence was considered as a barrier hindering many from acquiring computer skills. Further, in order to provide an understanding of what the computer could mean for everybody, it was seen as important to organise teaching in such a way that pupils could gain varied experience of what computers might be used for, for instance to calculate, make statistics, gather information from databases and play games. Thus, according to the 1983 plan, computing should not be a separate subject, but a part of several subjects such as social science, Norwegian, mathematics and science. It was also observed that if it was an option to choose *not* to learn about computers, the difference between the sexes could grow. This means that computing soon had gone from being a particular extra for particularly interested pupils to being recommended as compulsory both in primary, secondary and upper secondary schools, and as

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[9] St.meld. nr. 39 (1983-84) *Datateknologi i skolen*, Kirke- og undervisningsdepartementet.

[10] St.meld. nr. 39 (1983-84) *Datateknologi i skolen*, Kirke- og undervisningsdepartementet.

integrated in some subjects. In 1987, the Advisory Board for Primary and Secondary Schools (Grunnskolerådet) thus made a guide for implementing computing in all subjects in the curriculum.[11]

In 1993, the Ministry of Education presented the most detailed and concrete White Paper on computing in schools so far. The idea was that IT mainly should be used in ordinary subjects where it seemed natural, but people with special interests should also be allowed to choose IT as an elective subject. The White Paper stated as an overall goal that all primary and secondary school pupils should be familiar with the use of a keyboard and, eventually, gain basic word processing skills.[12] Thus, we see that keyboard knowledge continues to be regarded as the main entrances to computer knowledge.

The next plan for IT and education, meant to cover the period from 1996-99, opened by stating that:

> *(B)eing able to use EDP [electronic data processing] will be just as natural and necessary as being able to swim or ride a bicycle. Without any knowledge of information technology, one will be helpless and puzzled in more and more situations… We know that through conscious work and purchase of computing equipment, children of parents with good education and good financial situations often acquire necessary IT skills outside of school. This goes against our ideals about equality and gender equity… Equal access to education and training for all, irrespective of place of living, gender, social background, ethnic belonging and ability to function is the backbone and foundational principle of Norwegian education… Thus, it is important to stress initiatives which inspire and encourage women too to start using modern technology.*[13]

In about 15 years computing had transgressed from being regarded as something on the far side of school into being immersed in everything in school and society at large. Still, the digital divide was seen as ever-present. Around 1997 it was noted that there probably were considerable differences between different age groups in relation to computing that so far had been ignored. Thus, the Ministry of Planning and Co-ordination took the initiative to set up the so-called Elderly's and Youth's IT-

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[11] *Veiledning til mønsterplanen for grunnskolen 1987. Datateknologi i grunnskolen,* Grunnskolerådet, Univeristetsforlaget AS, Oslo.

[12] St.meld. nr. 24 (1993-94) *Om informasjonsteknologi i utdanningen*, KUF.

[13] *It i norsk utdanning. Plan for 1996-99,* Kirke-, utdannings- og forskningsdepartementet.

Forums to secure broader participation in the construction of the information society.[14]

The Youth's IT-forum focussed on making IT a natural and elementary part in all subjects. Further, school access to computers, Internet and e-mail for all was seen as necessary. The pupils were to be educated in and through the use of IT, and thus learn to critically assess information found on the Internet. Establishment of Internet cafes, chat rooms, web pages for different social groups and pedagogically useful computer games were also recommended along with granting the public access to computers in for instance libraries and city halls.[15] Further, it was recommended to disseminate inspirational "success stories" on girls and computing to a wide audience.[16]

One such inspirational dissemination was the booklet *One click and you're hooked* published by the Ministry of Education in 1999. This booklet continued the focus on Internet, the communicative possibilities and the potential of building networks through using the technology. ICT was seen to make school work more varied and real. The pupils, and particularly girls, should be allowed to actively make use of computers and the Internet as electronic diaries, and for instance through organising a pen pal association on the Internet where e-mail or chat is used to communicate with other pupils. To apply ICT in all subjects, also music, home economics, language and arts and crafts, was also seen as a productive strategy according to *One click and you're hooked*. But, first of all, the pupils must be secured access to the technology.[17]

The most recent plan for implementation of ICT in education, covering the period 2000-2003, continued the main argument that the education system should cater for all, and that it is important to counter a development of new divisions in access to and mastery of the new technology based on gender or social status. The new curriculum that was suggested, aimed at providing all pupils with knowledge of and experience with word processing, spreadsheet and the Internet as part of their work in different subjects.[18]

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[14] St. meld 38 (1997-98) *IT-kompetanse i regionalt perspektiv*, Nærings- og handelsdepartementet.

[15] *Generasjon Nett. Sluttrapport fra Ungdommens IT-forum*, 1998, Planleggings- og samordningsdep.

[16] *Generasjon Nett. Sluttrapport fra Ungdommens IT-forum,* 1998, Planleggings- og samordningsdep.

[17] *Ett klikk og du er hekta. Et inspirasjonshefte om jenter og IKT,* KUF.

[18] *IKT i norsk utdanning. Plan for 2000-2003*, Kirke-, utdannings- og forskningsdepartementet.

But, the main obstacle for active use of ICT in teaching is still seen as the lack of easy accessible computers and network. Thus, it is considered important to continue focusing on girls/women and ICT and adjusted teaching in order to avoid new differences between the sexes. ICT is by now expected to be fully integrated in teaching, and thereby contributing to equal opportunities for acquiring competence in, access to and use of ICT, irrespective of gender, region and social background. The last plan argues that it is important to continue to encourage girls to study computer science, and to encourage women to apply ICT as a tool for learning, for instance through conferences and development projects. Girls' and women's use of ICT should increase.[19]

Stable gender comprehensions

During the period 1975 to 1985, gender equality and equal opportunities had become commonly accepted as a value and important political goal in Norway. The Ministry of Education focused especially on the development of new subject areas in order to avoid new gender divisions. This was particularly important regarding the development of computing in schools. Thus, the case of girls and computing self-evidently serves as a good case of co-construction of gender and technology. As mentioned above, computers were not common in the standard education system around 1978, but only two years later, in 1980, trials were suggested initiated in order to integrate parts of computing education in the compulsory subjects mathematics, science and social science in secondary schools. Paradoxically, the Norwegian Gender Equality Association (Norsk Kvinnesaksforening) then expressed the importance of introducing computing *"in a natural way by placing computing in mathematics"*. [20]

Even though the Ministry of Education in their 1980 programme stated the importance of constructing attitudes towards computing in a manner which provided both girls and boys in schools with a basic introduction to different problems of the subject field,[21] mathematics, which is commonly held to be a masculine subject, was here seen as a natural computing subject. A combination which, with hindsight, was

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[19] *IKT i norsk utdanning. Plan for 2000-2003*, Kirke-, utdannings- og forskningsdepartementet.

[20] St. prp. Nr. 122 (1980-81) *Handlingsplan for likestilling, med særlig vekt på å bedre kvinnenens stilling i utdanning og arbeidsmarked*, Forbruker- og administrasjonsdepartementet.

[21] St. prp. Nr. 122 (1980-81) *Handlingsplan for likestilling, med særlig vekt på å bedre kvinnenens stilling i utdanning og arbeidsmarked*, Forbruker- og administrasjonsdepartementet.

seen as repelling to many girls, and which later was gradually replaced with efforts to integrate computing in all subjects and also in interest areas seen as typically feminine, such as communication.

Despite the relatively rapid development in the comprehensions of ICT over this period, the gender comprehensions are rather stable and clearly dichotomised. Further, this dichotomization is clearly co-constructed with different perceptions of ICT. When ICT is seen as something on the far side of school, as programming, or as related to science subjects, this implies boys as "natural" users of ICT and as the clever users:

> *Pupils that are lagging behind should not be left with mechanical drill exercises while the clever ones are doing their own programming. There is much evidence suggesting that computing education is more appealing to boys than to girls… It must be a goal to find forms of teaching where all pupils participate actively regardless of their sex.*[22]

In addition to few girls taking an interest in school computing, few women were students in engineering, including new and important fields such as computing. Women have been considered a potential resource for these areas due to their feminine qualities (see Lagesen 2003a), and also because qualified labour was scarce. Thus, it was important to increase the amount of female students in these future-oriented subject areas where women were more or less absent. The policymakers saw information and career guidance as means to get more women into these fields. Several ministries collaborated to launch information initiatives to encourage women to study unconventional subjects, that is, subjects commonly held to be masculine due to their scientific or technological nature. Choosing unconventional subjects in secondary school was also seen as an important stepping stone towards developing computer fascination and thus possibilities to choose informatics as profession. "*Both home economics and computing are central subjects for both sexes. Solutions will be developed to ensure that boys and girls gain the same basic knowledge here."* [23]

Again we see that computing can be seen as associated with masculine areas of interest, and that the goal is that women have to adapt to these areas. This follows the idea that access to the technology and information about its brilliance will make the women 'change side', that

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[22] St.meld. nr. 39 (1983-84) *Datateknologi i skolen*, Kirke- og undervisningsdepartementet.

[23] St.meld. nr. 69 (1984-85) *Om tiltak og virkemilder i likestillingspolitikken,* Forbruker- og administrasjonsdepartementet.

is, do as the men do. The policy represents an idea where a rather fixed comprehension of computing is strongly co-constructed with fixed notions of the masculine gender leaving little room for any possible female computing.

So, the term gender equality, mentioned as an important goal in all White Papers, is not easily "readable" or obtainable. In some cases it refers to acknowledging women the same rights as men (equality feminism), while in other cases it might refer to acknowledging the specificities of the feminine as equally valuable as the masculine (difference feminism), and in yet other cases it might be a combination of the two. The former seems easier to measure and operationalize through goals of reaching a 50/50 distribution of girls and boys in front of the computers; A strategy which depends on and reinforces the homogeneous dichotomised understanding of gender as two opposite sexes. And, a strategy which seems to be ever-present in the White Papers:

> *Gender equality should be central in all computer teaching. To promote gender equality it is important to avoid divisions between girls and boys when it comes to knowledge about and skills in using the technology. Not the least the uneven distribution of boys and girls in voluntary computing courses underpins this. Generally, one must work to give boys and girls even-handed relation to computer-related problems.*[24]

Along with the efforts to integrate computing in more subjects, the efforts to integrate computers in typical girls' subject areas were to be continued both within teacher training and software development according to the 1987 plan. It was considered especially important to have female teachers take part in experiments in order to give the school girls more female role models.[25] Thus, in contrast to the co-construction cases on the smart-house (Berg 1994b) and the microwave oven (Ormrod 1994), in the case of girls and computing we see an awareness about gender problems in relation to ICT and an interest in doing something about it. But these interests and efforts are informed by rather rigid dichotomous understandings of gender, which again influence the notions of ICT.

Despite expansions in the understanding of what computers can be used for, the notions of the gender divide, where computing is a natural

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[24] *Veiledning til mønsterplanen for grunnskolen 1987. Datateknologi i grunnskolen*, Grunnskolerådet, Univeristetsforlaget AS, Oslo.

[25] St.meld. nr. 37 (1987-88) *Om datateknologi i skole og opplæring,* Kirke- og undervisningsdepartementet.

part of the masculine interest areas, continue. The White Paper of 1993 notes that boys and girls have developed interests for different parts of the technology, and that girls and female teachers should be taught in classes for females only in order to learn, what can only be understood as, the valuable masculine aspects of the technology:

> *It is important that the dissemination of computer knowledge does not strengthen traditional gender divisions where girls are raised to "women do not understand" science and technology… 56% of the boys and 32% of the girls have access to a computer at home. Schools and society can not be indifferent to such a development.… Those who do not have access to computers at home must be ensured access elsewhere. The way new technology is brought into use can also establish new gender divisions. While boys apparently have been mostly concerned with the technological aspects, it seems as if girls are more interested in appropriate, useful applications in full. Girls too want knowledge about new technologies, but girls and boys make use of this knowledge differently. Thus, teaching in separate girl groups should be tried. This will provide useful information and experiences for the planning of teaching and use. Besides: Primary and secondary schools have 65 000 teachers, most of them women. Plans for teacher training should focus on covering women's needs. Municipalities should consider special classes for female teachers to make use of female experiences and ways of thinking regarding technology and to increase the teacher resources in the field.* [26]

By 1996 practical use of ICT, ICT integrated in the teaching in order to learn, was regarded as the most central also in order to include girls: "*Integration and application of information technology within a broad spectre of subjects in schools and education can strengthen girls' knowledge of and interest for application."* [27]

In sharp contrast to the initial "computing on the far side of everything", computing is by now seen to immerse in all aspects of school. Still, it was seen as important to carry on projects on teaching with IT that focused on girls' interests and qualifications and experiments with groups of girls only, maybe because girls were seen to domesticate ICT in a feminine, and thus, wrong fashion. Also, the plan emphasised the importance of attempts to increase female teachers' interest in IT and IT-training. This implies that it was considered important to make sure

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[26] St.meld. nr. 24 (1993-94) *Om informasjonsteknologi i utdanningen*, KUF.

[27] *Den norske IT-veien. Bit for bit*. Samferdselsdepartementet, 1996.

that female teachers were not "run over" by men with more technical experience, as was believed to have been the case frequently.[28]

In order to enable both sexes and all social classes to have equal opportunities to gain knowledge and skills in IT, the teaching, training and organising of this had to be aware that boys and girls from different social classes might have different interests and qualifications.[29] Again, despite the continuously broadening possibilities for applications of ICT, the dichotomous gender divide was still seen as a problem. But, with the introduction of class differences we also see a growing awareness of diversities within genders as well, about 20 years after the difference between boys and girls was first seen as the main problem regarding IT competence and interest. In 1997 it was noted that there probably were significant differences between boys, between girls and between different age groups that so far had been ignored. Thus, the above-mentioned Elderly's and Youths' IT-forums were set up to secure broader participation in the construction of the information society.[30]

The Youths' IT-forum's mandate was, among other things, to find ways to strengthen girls' interest in and knowledge of IT. They suggested development of girls' computer games and web pages. Girls' needs and desires should be considered by game producers, and municipalities should initiate efforts where the girls themselves could participate to become familiar with computing. The Youths' IT-forum also suggested the establishment of an Internet site called Youth Net in order to increase girls' online activity through communicating with other girls online. It was also suggested that girls themselves should be in charge of the girl pages on Youth Net and that they should produce content based on their own needs, for instance discussion groups, girl courses and a girl newspaper.[31] The Youths' IT-forum ended their report by arguing that girls tend to find computing fun if they just get started. However, they found that it was not likely that girls would get started on their own, in particular because of the lack of available computers in school. Further, The Youths' IT-forum argued that female pupils and students should be better informed about the computer science studies from an early age. At least, there should be established contacts between female upper

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[28] *It i norsk utdanning. Plan for 1996-99,* Kirke-, utdannings- og forskningsdepartementet.

[29] *It i norsk utdanning. Plan for 1996-99,* Kirke-, utdannings- og forskningsdepartementet.

[30] St.meld. nr. 38 (1997-98) *IT-kompetanse i regionalt perspektiv*, Nærings- og handelsdepartementet.

[31] *Ungdommens IT-forum, delrapport desember 1997*, Planleggings- og samordningsdepartementet.

secondary school pupils and master students at the universities. It was considered important that schools initiated girl related projects to stimulate their interest in computing, and that success stories from Norway and other countries should be published in a booklet.[32]

In 1999 the Ministry of Education published one such booklet – the above-mentioned *One click and you're hooked.* The aim of the booklet was to inspire girls to apply computing in school just as much as boys.[33] The booklet is very descriptive, emphasising what girls like to do and how they can be inspired to work more with computing. According to the booklet, girls like to apply ICT to communicate on equal terms and to build networks. ICT is seen to give girls self esteem and to accommodate girls' need for belonging, for instance through their strong interest in online communication. When a school decides to implement ICT, the girls should be able to learn first and gain the lead. The booklet recommended to organise a girls' room with available equipment, to organise the day so that girls are secured time with the computers, and to make sure girls are trained as supervisors and in system and user support. If boys and girls are to be in the same room at the same time, let the girls get in a bit earlier than the boys in order to secure access, the booklet recommends.[34]

Further, teachers' competence is seen as a basic prerequisite for successful implementation of ICT in schools. In order to increase female teachers' interest in ICT training, the Oslo College started experiments with classes for female teachers only. This has apparently shown positive effects on the learning environment and the results of the female students. But, the main obstacle for active use of ICT in teaching is still seen as the lack of easy accessible computers and network. Thus, in 2000 it was considered important to continue focusing on girls/women and ICT and adjusted teaching to avoid new differences between the sexes, and to increase the amount of female students in science and computer science. ICT was by now expected to be fully integrated in teaching, and thereby contributing to equal opportunities to acquire competence in, access to and use of ICT, irrespective of gender, region and social background.[35]

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[32] *Generasjon Nett. Sluttrapport fra Ungdommens IT-forum,* 1998, Planleggings- og samordningsdep.

[33] *IKT i norsk utdanning. Plan for 2000-2003,* Kirke-, utdannings- og forskningsdepartementet.

[34] *Ett klikk og du er hekta. Et inspirasjonshefte om jenter og IKT*, KUF.

[35] *IKT i norsk utdanning. Plan for 2000-2003*, Kirke-, utdannings- og forskningsdepartementet.

With the Youth's IT Forum and *One click and you're hooked,* the gender diversity awareness seemed to quickly vanish to the advantage of co-constructions of gender and ICT that, fair enough, aimed at more positive and optimistic opportunities for women, but which nevertheless were built on strict binary gender comprehensions.[36] Despite the changing and widening comprehensions of the technology from EDP via IT to ICT, gender is still perceived more as dichotomous biological sex than social and heterogeneous gender in the White Papers. This also means that throughout the entire 25 year long period in focus, girls are seen as inferior to boys in the White Papers when it comes to use of ICT.

The 'girls and computing problem' thus seems like a never-ending problem according to the White Papers. It is thus interesting to turn to the policymakers in order to see how they perceive the problem and possible solutions.

The policymakers' comprehension of girls and computing

Computers are simple typewriters and advanced programming

The policymakers have, both individually and together, complex understandings of computers and computing, as was also partly the case with the White Papers. Computers are seen as simple and advanced typewriters, educational machines, means of learning and teaching and as a tool. Further, computers, and especially the Internet are described as textbooks, encyclopaedia or as reservoirs of knowledge:

> *No one would have accepted that the pupils would have to share textbooks, thus we cannot accept that they have to share computers* (politician in the UF-committee).

At the same time as access is regarded as essential, many of the policymakers think introducing computers to too young children can be dangerous, and that computers make us antisocial. Additionally, computing is seen as a problem because it opens a whole world for the children they do not really need:

> *Generally a lot of unfortunate things happen on the Internet, as flirting and the fact that a new language is developing. On the other hand, it is positive that the users are becoming familiar with the computer through such use. This doesn't, however, compensate for the negative aspects, like the Internet reinforcing traditional female*

[36] See Spilker and Sørensen (2003) for an interesting parallel of dichotomous understanding of gender in commercial attempts to make girls and women active computer users.

> *stereotypes. Computing contains many extreme features that should not be part of teaching* (politician in the UF-committee).

But generally, all policymakers perceive access to computers as crucial. Access is important because many policymakers think computing makes the teaching and learning processes more interesting, fun and inspirational, for instance through international communication. Thus, it is important to make the pupils familiar with computing. At the same time, what is seen as computing varies a lot in some regards:

> *Computing is different for a 6-year old and a Ph.D. student. They do not have the same needs for equipment* (politician in the UF-committee).

Thus, most policymakers regard computing as something that can be learnt on several levels. Computing as a tool is not difficult to learn. Producing programs on the other hand is seen as very difficult. It is difficult to understand how the programs work. To become a computer engineer is thus perceived as very difficult. In line with the emphasis in several of the White Papers, the policymakers see basic computing only to demand keyboard knowledge, while knowledge about the systems behind the programs, the black boxes, requires skills in science and mathematics. Thus, at the same time as computing is regarded as a trivial technology in line with TV and telephone, computing and computers are also seen as technology, engineering, programming and typical masculine interests:

> *Girls are afraid to choose informatics because they find it so over-complex. They don't quite know what people in informatics do. When they find out, they think it seems exciting* (civil servant in UFD).

> *Way too many girls go for the safe and secure, not for the challenging and exciting computing jobs. The IT industry has kind of this Texas culture where you work late, which is not easily combined with having a family. It's kind of a pizza and coca cola-culture. Is that compatible with having children in a few years time? The girls choose to take some computing classes rather than completing a full degree. They are sceptical towards becoming computer engineers and having nothing else to lean on* (civil servant in UFD).

Summing up the policymakers' constructions of the meaning of computers, it is important to point to the policymakers' complex and paradoxical construction of computing. Computing is trivial and advanced, useful and dangerous, tool and toy, programming and communication, scary and fascinating. These constructions differ

somewhat from the impressions we get from reading the White Papers, where computers mostly are regarded as the key to a prosperous future, and as having qualities that inherently make them interesting to everyone who are granted access. Further, both in the White Papers and the interviews, the technology is to a large extent described in gender-neutral terms and as a fixed culture. The apparently inherent quality of computers, which boys are seen to have understood and developed an interest for, is seen as gender neutral, and as the yardstick everyone must follow in order to reach full gender inclusion. It is thus interesting to take a closer look at how the policymakers construct the users of this apparently gender neutral technology.

Boys are like this and girls are different

Most policymakers believed that boys had a tendency to occupy the computers while the girls are set aside and are being instructed by the boys. The remedial action is thus to recommend that the girls have a go on their own in accordance with the stress on access and girls-only initiatives in the White Papers. Simultaneously, girls were seen as someone who do not dare jump into the deep end, they do not dare to oppose the typical girls' norms, which apparently do not go well with computing:

> *Girls are conscientious and devoted. Boys and men are a bit more playful, especially when it comes to technology. They are less afraid of using the computer. They just go ahead and start using it* (civil servant in UFD).

As noted above, one of the main problems is perceived to be that girls have less access to computing equipment. At the same time, policymakers believed girls to be more instrumental towards computing, but also that girls are oriented towards communication while boys work differently:

> *Boys are more into games and thus they have learnt the technical issues. As the Internet has grown and chatting has become more common, girls are starting to appear* (civil servant in UFD).

The policymakers thus believe two camps of computer users have developed where boys play in the one and girls chat in the other:

> *Boys too can find it amusing to communicate, but they communicate more by giving each other advice on games and such when they play together. Boys usually do something when they are together, while girls like to go to a cafe and talk with each other. Computing was kind of uninteresting to girls before we had the Internet. Girls used to think games were about jumping, pink horses, just boring. A*

> *qualitative change in girls' interest in computing came with the Internet and e-mail* (civil servant in UFD).

Prior to this communicative turn, the policymakers thought that girls mainly used the computer as a typewriter. The transition from EDP to ICT has thus expanded the girls' potential for computing because:

> *Many girls think it is fun to make nice assignments and gather information from the Internet. Girls have always been better at that than boys. Girls have always liked better than boys to send each other small notes. Girls have more social antennas and are therefore engaged in discussions and important work on the machine* (civil servant in UFD).

Even with this positive extension of girls' potential for computing, all policymakers found women to be more reserved in their use of computers, and that boys to a larger extent have the necessary self-confidence to make use of computers:

> *Many boys have better technical self-confidence than girls and faith in their own abilities, maybe a bit exaggerated. The girls would do just fine if they had learnt what these concepts were all about, like some beginners' classes now do. Girls have a tendency to believe their questions are stupid. Girls often feel they don't know things well enough. Girls aren't that handy, they don't have the ability to go for it and try something new, something they feel they will have problems mastering. Boys do have that ability, and they certainly destroy a lot while they are learning to master* (civil servant in UFD).

Despite the fact that most policymakers constructed such oppositions between girls and boys and their computing interest, all of them believed that access was the key issue. If only girls were given access to their own computer, boys and girls would be just as clever. Given the strong contradiction the policymakers perceive between boys and girls, it seems ironic to believe that full access for girls will automatically make them more interested in computers.

Girls are described as idealistic and realistic regarding job and career, but this is also associated with the fact that girls are seen to choose shorter computing classes rather than becoming computer engineers. Typical feminine traits, which are described as positive, are not seen to go well with computing, in contrast to traits described as both masculine and more negative:

> *Women seem to think more about life in full. I want a job, but also a family, what would be compatible with that? Girls choose profession based on possibilities for getting a safe job. Boys jump*

> *and bounce here and there. There is an extreme wish for security in the female nature that is not present in the male nature to the same extent. Way too many girls go for the safe and secure and not the challenging and exciting* (politician in the UF-committee).

In addition to being thrill seekers and less idealistic than girls, boys are seen to be more easily "hooked on games and such". The policymakers are in practice talking about THE opposite sex:

> *We must remember that there are two sexes that might have different approaches to computing, and we must provide for both* (civil servant in UFD).

This dichotomization of the sexes, which is probably done with the best intentions for equal opportunities, makes it difficult not only for all girls, but also for the boys deviating from the masculine norm. This kind of gender perception leaves little room for movement or change.

> *We don't see the same gender differences in primary school as higher up in the system. The question is whether this is a generation issue or if it is the construction of the teenage girls that create the problem.... We must start the equal opportunities work before puberty takes a hold of the girls, because then they are too busy becoming women.... Female role models are important because girls are fairly oriented towards gender stereotypes* (civil servant in UFD).

The above quotations show clearly that gender problems are seen to equal girls' problems also for the policymakers, which goes well with how the problem has been addressed and labelled in the White Papers through the entire period. It has always been "the girls and computing problem" which indicates that boys have got the message right in contrast to girls. Many policymakers are at the same time puzzled over the inconsistency they see between their own experiences and the co-construction they make of girls and computing:

> *At a work place no one would think of computers in relation to gender, because it is a tool all of us use every day. If there are someone here at UFD who don't use computers, it's the men. All women here use computers* (civil servant in UFD).

The previous paragraphs on the constructions of girls and boys show that they are constantly co-constructed in the sense that they always are arranged in contrast to each other. We also see that this affects the co-construction of gender and ICT, which I will discuss further in the next part. Girls are seen as conscientious computer users while boys are playful, girls communicate and boys play games, boys are experts and girls are users. In this way feminine and masculine ways of using the

computer are co-constructed and placed in a hierarchy. The gender-technology relation involves the production and reproduction of a hierarchy between women and men and even, in a sense, between the technical and the social (see Cockburn and Dilic 1994, Faulkner 2000). Even though it is not seen as especially positive that boys spend a lot of time on computer games, this type of knowledge is seen to lead to future computer expert jobs. No matter how idealistic, realistic and instrumental girls are seen to be when using computers, they are still described as afraid, uncertain and without the right skills. Girls are constantly seen as deviants and are downgraded due to the norms that arise from the co-constructions of gender and technology, or more specifically, of boys and ICT.

Further, this implies that as long as gender is perceived as two so clearly separated and fixed categories, the hegemonic notions of men and masculine values are seen as the model everyone must apply and go by in order to achieve full equal opportunities. None of the policymakers advocated or suggested more nuanced constructions of gender roles, despite the fact that many of them reported deviations between their own observations and the common constructions of gender stereotypes. Even though some informants pointed to the fact that their daughters were more interested in computing than their sons, or that many women are better at computing than men, this was not the same as saying they were seen to be the cleverest ones at computing. These women are seen as clever in the female, instrumental and decorating way, not in the masculine, technology mastering and absorbing way – which is seen as positive because it leads to expert knowledge.

Girls are good at decorating and boys are computer experts

Most policymakers believe training and practice (and thus access and information about the brilliance of ICT) is all it takes to make everyone familiar with using computers as typewriters, learning machine and to gather information from the Internet. It is seen as important to learn to treat the equipment right, learn to search for information and to use the machine as a tool to seek relevant knowledge. The necessary computing skills are thus seen as rather basic:

> *Computer knowledge for a primary and secondary school pupil should include ability to consider the information sources, search the Internet, search and find whatever is needed. Computer knowledge is first of all mastering of word processing, and simple Windows so that they can navigate. The next step is spread sheet, Internet, advanced word processing and e-mail* (civil servant in UFD).

Further, girls are generally seen to be good at the basics. Girls' computing is seen as reasonable, rational and effective. Many policymakers believed that girls' competence in these fields might lead to a deeper interest for the computer in it self. It is apparently not sufficient that girls are clever at making use of the computer when needed for their schoolwork, because it is seen as important that girls and women participate in the production and development of the technology on a higher level. To nurture an interest for that, girls apparently have to go from being ordinary users to becoming fascinated with and absorbed in the technology just as the boys are perceived to be. This is in line with studies showing how male engineers grew up fascinated by tools, machinery and gadgets, and thus, engineering was a "self-evident" choice of trade for them (Margolis et al. 1999, Mellstrøm 1995), and that obsession with hands-on tinkering is an important element in engineering cultures. But, such studies also show that many female engineers grew up without tinkering and technology obsession (McIlwee & Robinson 1992). In this regard it is also interesting to note recent studies by Vivian Lagesen (2003b) and Hege Nordli (2003). These studies indicate that computer fascinated women prefer to keep their fascination as a leisure activity and thus they choose other fields of work, and that female computer engineering students entered the programme more for its career building potential and not because they were particularly fascinated by computing it self. Thus, female technology fascination is neither a prerequisite nor a guarantee for women to choose computing.

So, the policymakers juggle between acceptance of and to a certain extent fascination for but also dissatisfaction with girls as ordinary computer users on the one hand, and a disapproval/fascination of masculine technological obsession on the other:

> *One girl wrote a letter to a friend and did her homework at the same time as she paid attention to the teacher. She really could master doing three things at once. Since girls and women are better at doing several things at once, they might be better at using the computer in that manner, while boys usually sit with their game and are very much focused on one thing* (civil servant in UFD).

Despite many such positive constructions of computing-girls and negative constructions of computing-boys, boys are still ranked as the cleverest in the co-constructions of gender and computer knowledge or competence:

> *Boys usually have more of that expert knowledge, so that they single-trackedly can investigate the issue. There are probably such female hackers as well, but certainly not that many. We are maybe a bit fascinated and seduced by the fact that they master it so well,*

> *have that type of expert knowledge. While the other stuff, that is more common, something everyone knows or ought to know* (civil servant in UFD).

The constructed expert image of boys implies spending a lot of time and being single-trackedly interested in the field in order to master the technology. Additionally, you must master the language and be able to crack the codes:

> *A survey conducted in 9th grade showed that a small group of boys knew all these technical notions. These boys, being so competent at an early age, we'll see them studying informatics in some years. Next, there were many boys where you couldn't quite read out of their answers whether they were boy or girl. They had high computing interest, but didn't quite know the right definitions. I don't know where they'll end up, if they only become users like the rest of us. But we could also see that very few girls had this perfect "boys' room competence". There was a core of boys who knew a lot, and who have technical interests that go beyond what they need for just playing games or using the machine. And then there is a group of boys who know a lot about how many MB and such you need in order to play a game, and they learn quite a bit about the technology, while many of the girls knew what the different things were, but they didn't apply the technical notions, they could just about say what the notions meant* (civil servant in UFD).

Again we see the stress on how technological fascination and playfulness apparently leads to higher computing competence. Despite this perceived importance of being able to crack codes, in many regards computer knowledge and competence have little to do with technological competence according to the policymakers. Being clever at computing means being clever at typing, communicating, reading important information and evaluating the reliability of this information. Girls are seen to be clever at this because they like being clever and conscientious pupils and to decorate their assignments. Further, computing is constructed differently in the policymakers' minds, and thus this should open for many ways of being clever at computing because there are so many different arenas to master. Still, when gender and technology is co-constructed, and the gender comprehension in use is dichotomous, the complex ICT arenas are accordingly organised in a hierarchy. This hierarchy separates between ordinary use and mastery of the technology or the black box. Ordinary, simple computing, which girls often are seen to be good at, is seen as elementary knowledge everyone is expected to know. It is the technological, single-tracked and masculine expertise in computing which is constructed as the highest computer competence.

Additionally, this type of computer knowledge is co-constructed so tightly with the masculine sex that the policymakers expect to be able to read the sex out of the computer user's competence level. Policymakers thus hoped that establishing a feminine ICT would urge the girls to be so interested in the technology in itself that they would want to open the black box and become just as clever and interested as the boys. Despite the observed communicative turn, where girls were seen to find computers interesting because of the possibilities offered through the Internet, the feminine computing that evolved was apparently not technological enough.

20 years of focussing on the problematic relation between girls and computing have still not given satisfactory results according to the policymakers. But, the apparent lack of results is probably related to a perspective aiming for 50/50 distribution of girls and boys as computer engineering students rather than as ordinary school computer users. The technology has changed, but the girls are perceived as almost just as absent in front of the computers, or they have developed a feminine computing which does not lead to the masculine expert knowledge apparently in need. I will not suggest there is a kind of hypodermic needle relationship between the policymakers' co-constructions of gender and technology on the one hand and the teenagers' co-constructions of their own gender identity and technology comprehensions on the other. There are many other crucial actors in this interplay, such as technology developers, marketing departments, media, school, family and not to mention other youths or peer pressure. Nevertheless, the administration of a country is based on an idea about influence. The policies make certain limitations and leading conceptions for how the girls and boys can construct themselves as computer users, and also for which political ends and means to pursue. Developing expert knowledge among young girls may be important if the goal is to recruit more women to ICT professions, but this is a prerequisite questioned by recent studies (see Lagesen 2003b and Nordli 2003). Paradoxically, the primary explicit goal of the White Papers is in stead to make everyone familiar with ordinary computer use, which most policymakers perceive girls to be good at, but still, apparently not good enough, due to the policymakers' choice of which application to rank higher, which again is linked to their choice of implicitly aiming more for female computer engineers than girls as ordinary computer users.

Female computing as a deviation from the norm

The dualisms found in this material are numerous. Many of them appeared in the interviews, where the policymakers were able to speak

more freely and casually, and thus stereotypes were more easily used. The texts on the other hand are more prudent, and further away from the policymakers' immediate thoughts as expressed in the interviews. We can say that a kind of purification process appears to have taken place from mind to paper. Nevertheless, the White Papers offer ample dualisms that are set into play, and these are further supported and extended by the interviews. Even though computing historically is seen as part of a continuum from EDP via IT to ICT, and is mainly defined as the basics word processing, Internet, e-mail and spreadsheet, we have seen that many more features have been attributed to the technology. More or less all of these features have appeared as dualisms. I have chosen to map out a tentative table to sum these up in terms of status as more or less valuable:

More valuable	Less valuable
"'Technology"	Tool/useful
Tinkering	Mechanical drill programs
Complicated/advanced	Trivial/routine
Challenging/exciting	Safe/secure
Access	Lack of access
Expertise/mastery Computer engineer students Students	Normal use Lower level computing classes Non-students
Programming	Communication
Games	Chatting, e-mail
Fascination	Reluctance
Direction of value	more questionable
Science/math	All subjects/information
Toy	Tool
Single-tracked use	Heterogeneous use

Even though the table consists of dualisms, it is somewhat in accordance with the theoretical recommendations of viewing technology as non-essencialistic, and the dualisms *can* be seen as ends of a continuum. The technology can be seen as flexible and it is interpreted differently by the actors. Nevertheless, the impression is still informed by rather dominant dualisms. Further, as stated initially, we cannot understand technology without reference to gender because they are intertwined in a seamless sociotechnical web where the elements are combined in networks of meanings and practices. Thus, when we add gender to this table, a sad process of locking appears. And that is not because gender is added in the end and not "stirred well enough into the rigid mixture of technology", but precisely because the policymakers

have been co-constructing binary gender comprehensions with ICT dualisms all along in a manner which allocate the masculine to the left column of the table and the feminine to the right. And since gender is perceived as binary and not a continuum, this sets aside the potential flexibility of the technology, and locks it in one feminine and one masculine version of the technology. This lock is further jammed by the particularly strong contradiction constructed between ordinary everyday use and the fascination for computer engineer expertise.

The explicit goal of the policy is to make girls competent as computer users. The implicit goal is to make women and female computing the same as men and male computing, as shown in the analysis of policymakers' co-construction. The expected out-come of this, which in practice can be called a masculinisation project, is thus to see a 50/50 distribution of girls and boys in front of the computers, and implicitly in higher level computing studies. The results in this regard are improving, but it is rather impossible to establish whether this is actually a result of the policy or of other aspects in society, such as girls' active and "opposing" co-constructions of gender and computing and the general diffusion of ICT in more and more areas. What we can see from this analysis is however that the policymakers' co-constructions lead to a hierarchy of computing, with a division of common computing on the bottom (the right column of the table) in contrast to constructions of more advanced ICT mastery on the top (the left column of the table). And that this hierarchy is further reinforced through the strong co-construction with binary gender comprehensions. In this hierarchy the co-construction of boys and computing make the norm which girls and computing constantly deviates from. This contributes to an idea that gender equality is achieved when the girls have become just as eager and competent as the boys based on the relative status of the masculine approach.

For obvious reasons the policy co-construction of gender and technology can be said to have failed because it has not taken seriously the socio-technological point that gender and technology are knit together in a seamless web where gender and technology are flexible and can not be seen separately. Rather, it seems as if the policymakers are trapped in a semiological way of reasoning where all weight is put on polarisations, dichotomies and hierarchies. In other words, the policy-making does not open up to the possibilities of change given by the flexible gender's interplay with the flexible technology. True, to a certain extent technology is seen as flexible and changeable, but this is more in a historical context and in a boys versus girls context. When it comes to gender, the dichotomous, rigid and hierarchical understanding is clutched with both hands – a comprehension that always will construct

girls as losers, inferior or in best case as different. This is further reinforced by the strong dualism between computer engineer/boys' room expertise and ordinary computer use.

The comprehension of the girls and computing problem would thus have been totally different, if not absent, if the policymakers had been more open to heterogeneous understandings of gender and the fact that secondary schools are an arena for teaching ordinary computer use, not educating computer engineers. Because, the analysis shows clearly that the policymakers perceive girls to be rather good at ordinary, everyday computer use. Thus, the girls and computing problem is not a never-ending problem as the White Papers and policymakers seem to believe. Further, the table above also indicates traces of elements saying that things could have been and can be different. According to the White Papers computing is no longer supposed to be allocated in science and matemathics, but is supposed to be used in all subjects, which again will/does open up for all kinds of girls and all kinds of boys as computer users in some way or other. Even though boys are admired for their ability to play with the computer and to immerse single-trackedly in the technology, this admiration also has a flip side when girls are admired for their ability to apply the technology as a tool in heterogeneous ways.

Further, inequality between boys and girls does not necessarily mean the same as injustice.[37] Differences between boys and girls are not inevitably inherently bad. But, when the gender comprehension is strictly dichotomous and co-constructed with a strongly hierarchical comprehension of ICT, that is, when gender and technology are locked in dualisms, we can observe a process where the possibly positive aspects are constructed as negative, and where girls can only achieve success if they jump over to the masculine side of technology.

[37] Thanks to Anne-Jorunn Berg and Sally Wyatt for suitably reminding me about the difference between inequality and injustice at the Gender, Science and Technology workshop in Trondheim May 2003.

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SEDUCED BY NUMBERS?

How and why is research on girls and computing applied in decision making?

Girls' apparent lack of computer interest has been regarded as a public problem in Norway for about 20 years and thus been subjected to thorough research. Such research is often funded by, or the results are attempted communicated to, politicians and policymakers due to an idea that research results and knowledge make grounds for the best possible decisions in order to solve the problem.

Social science makes use of both qualitative and quantitative methods to investigate social problems. Quantitative research methods can for instance help illuminate a problem by detecting serious and important biases. Such figures are informative, very concrete and easy to distribute to politicians, media and the public at large. The figures are often perceived as solid facts that show that boys are far more interested in computing than are girls.

Qualitative research on the other hand does not focus on quantities, but tries to illuminate unique features of the matter in question. Rich material on for instance why and how different the teens actually make use of the computer is gathered through long interviews with boys and girls regarding their own (lacking) experience with and their ideas of computers and computer users.

This article will focus on how research results regarding girls and computing is interpreted and applied in policy making. I first describe some of the available research findings regarding girls and computing, before I make a theoretical approach to how and why (not) research results are applied in policy making and what kind of research is perceived to be reliable and trustworthy. Finally I discuss the interpretations of the research results on the part of the decision makers and the choices these seem to lead to. I will show what policymakers and politicians regard as their knowledge base on girls and computing, and how they more or less systematically diminish qualitative research results or narratives as not useful or scientifically reliable.

Available research results on girls and computing

All the numbers point in the same direction

In 1990 in Norway, 44% of the students in secondary schools had access to computers at home, 56% of boys and 32% of girls (IBM in St.meld. 24). Results from a quantitative survey conducted by SSB (Central Bureau of Statistics) in 1995 showed that in secondary schools 62% of boys and 52% of girls had access to a computer at home. Over 50% of these boys claimed that they are the most frequent users, while only 20% of the girls claimed they use the home computer the most (IT i norsk utdanning. Plan for 1996-99). This is in the White Papers interpreted as a considerable difference between boys and girls regarding interest for and use of IT.

In 1999, the number of students per available computer in secondary schools in Norway is 8,9. This is relatively higher than in other countries, but equipment is not up-to-date (SITES 1999 in IKT i norsk utdanning. Plan for 2000-03). Half of teachers have participated in computing courses in the use of spread sheets, the Internet and word processing. Under 20% of teachers have participated in courses on how to implement computing as a teaching aid (Fafo 1999 in IKT i norsk utdanning. Plan for 2000-03).

The numbers showing teachers' lack of computing knowledge and girls' lack of interest and access to computers have been relatively stable over the 20 years long period where girls and computing has been regarded as a problem in Norway. Quantitative research for this period show an increase in the numbers of available computers and computer knowledgeable teachers, but only minor changes in the relation between boys' and girls' computer interest. We can thus say that the numbers indicate a positive development, but that there still is a problematic relation between girls and computing, especially when compared to boys' interest in computers.

The narratives cover many stories

On the basis of quantitative data on computer use and gender in Norway, we can see that boys have greater access to knowledge making in computer mediated environments. Qualitative research results show for instance that the differences are most apparent regarding computer games and technological conceptions. Still, only a small minority of the boys know the exact technical definitions while many boys are not particularly confident on the definitions (Vestby 1998.)

Qualitative research has also shown that many girls do not perceive their own computer use as proper computer use. "Proper

computer use" is defined as useful computer use like daddies do at work, and "proper computer users" are anti social boys who have no friends and spend all their time in front of the computer (Gansmo 1998). Additionally, qualitative research shows that many young girls think it is fun to play with the computer, communicate and explore the different programs on it, and what happens when they push the different buttons (Ibid., Håpnes and Rasmussen 1997, Kvaløy 1999, Nordli 1998). When qualitative research shows that some girls' definition of "proper computer use" is not in line with the use they make of the computer themselves, we should heed a warning that the numbers are not necessarily so clear and obvious after all, and be suspicious that, in many quantitative surveys, such girls might have reported their own computer use and knowledge as being too low.

Qualitative research opens up for differentiated understanding of gender by for instance showing that some girls understand the computer as a fun toy they have full freedom to play with, other girls play with the computer but claim they are using it for useful tasks like information gathering and school work. A third group of girls finds computing dead boring, but since computing is regarded as the key to the future they feel they have to be smart and learn computing for useful purposes. A fourth type of girls find computing the most exciting activity in the world, and use it just as much for fun as for useful tasks (Gansmo 1998, Nordli 1998). When girls can be so different and make such different use of the computer, it seems natural that they also define "proper computing" differently.

Qualitative research has shown different levels of computer confidence and knowledge among boys, that girls seem to be intrigued by the communicative aspects of Internet, that girls think computing is fun, and that girls have different interpretations of computing. Thus the qualitative research results challenge the dichotomous understanding of gender and the notion of a "gender divide" when it comes to computers and learning.

Use of research results in policy-making and public administration

Social science research is increasingly funded due to an expectation that the research results somehow will be directly useful for society as a whole (Naustdalslid and Reitan 1994). The public debate on the usefulness of research rarely separates social science research from other kinds of research. Much of the debate is based on the assumptions we have of how scientific research results may enable us to solve specific problems. The idea is that social science can provide humans with

similar control over society to what we eventually have gained over nature (ibid.).

Sociology of knowledge has traditionally drawn a distinction between (natural) science and non-science subjects like art and social science. The latter has been regarded as the outcome of its historical and social context, while the laws of (natural) science have been seen as independent of their context. It is seen as objective, value-free knowledge independent of the observer. This positivistic view has become part of common-sense knowledge of our society. Even though we know little about nature we accept scientific findings about it to be true (McNeill and Townley 1981).

On closer examination we may discover that the evaluation of social science's usefulness is based on the same ideal as the natural sciences. Research results should provide decision makers with solutions to problems they otherwise would not have been able to solve (Naustdalslid and Reitan 1994). Research is therefore evaluated more on the basis of its practical usefulness than for its status in academia (Weiss 1978). This makes it likely that decision makers are not really concerned with whether the information is based on true or scientifically consolidated knowledge. Indirectly this might still be important because decisions based on questionable knowledge might be drawn into question and be thrown back at the decision makers. It is therefore likely that decision makers would like to cover their backs by applying only what they perceive as true research results (Naustdalslid and Reitan 1994).

That natural scientific solutions often are understood as more objective and universally valid, might make it easier to overlook or reject social scientific suggestions. In cases such as that of girls and computing, where more or less only social scientific research is conducted, it is likely that qualitative research solutions are dismissed because the quantitative research solutions are perceived as more naturally scientific and, hence, more true. Or, as Einar Lie and Hege Roll-Hansen (2001) put it, power is gained through figures and statistics and those in power know how to stay in charge by using figures and statistics.

Research results applied in different ways

It might be just as relevant to ask why research results are applied at all as investigating why it is not being used. Doing that, we can distinguish between four main categories for use of research which are not necessarily mutually exclusive: informative, instrumental, strategic and symbolic (Naustdalslid and Reitan 1994).

The informative application of research (un)consciously contributes to shaping our notions of society, our conceptions of cause

and effect, and the perceptions of current problems. This kind of research application is to a lesser extent aimed at specific decisions, but more towards having an effect on how society works in general (ibid.).

Instrumental use of research, on the other hand, means concrete, goal oriented use of research results to solve specific problems. In order to use knowledge from research results instrumentally the results must have a possibility to inflict on the social realm (ibid.).

Strategic application of research results is conducted when decision makers who are convinced they have the right solution, choose to apply research in order to communicate their opinion and convince others that they are right (Langley 1989). This is based on an idea that arguments funded on research will strengthen their stand and contribute to giving the opinion legitimacy (Feldman and March 1981). This does not mean that the research it self is biased, but that the policy maker applying and presenting it is biased (Nilson 1992). In order for the strategic application of research to be effective and credible, it is crucial that it comes out as instrumental, and as an unbiased expression of truth (Naustdalslid and Reitan 1994).

Symbolic use of research results occurs because the public administration is part of a ritual game where the participants must fight for their credibility (March and Olsen 1989). It might be more important for politicians to make it look like they are active and goal oriented than to make the changes actually happen. Initiatives to fund research, for instance on girls and computing, might be presented as an interest to actually do something about the problem (Naustdalslid and Reitan 1994). Thus, research might be applied to give a symbolic impression of rationality and efficacy that in turn contributes to the credibility of the decision (Langley 1989), and hence the symbolic application of research is strategic (Naustdalslid and Reitan 1994). In such cases, it is of no importance what the research results say, but I will presume that the more rational the research seems, the better, and, in practice that means scientific research rather than social science, and numbers rather than narratives. This goes along with the observation made by Martha Feldman and James March (1981) that intelligent choices and systematic and goal-oriented application of information is perceived as the ideal basis for decisions in western ideology. To possess information in itself gives credit to the organisation (ibid.).

When research is not applied

There may be several reasons for not applying available research results in public administration. We may look for the causes among the users, within the research itself or in the interaction between these two worlds. Simplified this might be summarised in three not mutually exclusive

reasons for not applying research. 1) There might be organisational issues among the decision makers which keep them from using research. 2) The research is not relevant or is not made easy accessible for the users due to layout, academic quality or methodological approaches. 3) Or there might be cultural differences between the two worlds causing problems with the "translation". Research application is additionally a question about the individual characteristics of the decision maker, their education, trade and beliefs, and a question about structural features of the user organisation (Naustdalslid and Reitan 1994).

Good research is not necessarily equivalent to relevant research. Good research is known to study the matter in depth, provide information on relevant issues and details in order to find new and surprising results – which will make the decision process more complicated. Relevant research on the other hand is available in a simple and surveyable form when the decision maker needs it, and it must provide knowledge that can contribute to making the decision process easier (Ibid.).

Research is not particularly relevant if it is mainly concerned with explaining social phenomenon that cannot be influenced through decisions. This might explain why research concerned with big social issues and institutional systems, class and power, does not produce a type of knowledge politicians and policy makers feel they can use to solve specific problems (Ibid.) It is likely that much of the qualitative research on girls and computing has provided exactly this kind of explanations, explanations about construction of gender due to institutional relations, and that this is one of the reasons why policy makers find it hard do apply and operationalise qualitative research results on girls and computing. Knowledge gained from qualitative research is not necessarily hard to access, but it can make the decision process more difficult, and it sometimes points at explanatory variables which are perceived to be out of reach for the decision makers, such as the argument that computers are not perceived as a uniform technology, but used and perceived very differently by different people.

Translation of research results into socially robust knowledge

Recent research, conducted by studying the knowledge production and application as a process of negotiation between different actors, has contributed with another insight into how research results are (not) applied and interpreted, and how research results are (not) granted status as authorised facts (Gibbons 1999, Latour 1987, Nowotny, Scott and Gibbons 2001). The laboratory as a metaphor for all research is central in all decision making because most controversies mobilise scientific

expertise. Research results are used to grant legitimacy to political goals and means (Latour 1987).

The research process might be described as a journey that in the end goes from the researcher's publication to the policy maker's interpretation of it, which again leads to either rejection or application in some way. When something is on the move, like for instance research results, new understandings might occur, for instance due to the network the research results are perceived to be connected to, both regarding research institutions, other results and the experiences of the user. The translation process is central in Latour's approach, and we might say that politicians translate the relevant research into narratives. The interpretation of the research is delegated to the users, and they may choose to interpret it differently than the researcher intended (Ibid.). This implies that even though research is mobilised as a resource in controversies, research is not necessarily granted power or authority.

Michael Gibbons (1999) notes that there has been a social contract built on trust between society and three relatively independent actors of scientific research: universities have generated fundamental knowledge for society. Industrial research and development departments have carried scientific knowledge into products and innovations. Finally, governmental science has filled the gap between the two other actors. Under this contract science has been expected to produce reliable knowledge and make it available to society.

Changes in the relation between these three actors (for instance due to the end of the Cold War and a change in the interests of the state), the expansion of higher level education, an increasing focus on object-driven research and a desire to get something in return from the research-funding, has led to the need for a new social contract. Science is now produced in more open systems of knowledge production. Thus a complete re-thinking of science's relation to the rest of society is needed (Gibbons 1999, Nowotny, Scott and Gibbons 2001). The price of this increased complexity is a pervasive uncertainty, and erosion of society's stable categorisations and of the ideas of truth and authority. Consequently science can no longer communicate its reliable knowledge to society through a monologue, as it has done successfully for the past centuries, but society can now speak back to science. In the old contract the autonomy of science was seldom questioned, and science was seen as basis of all new knowledge which it was expected to communicate to society, which in turn was supposed to transform the knowledge into action. It is less often appreciated that society is also transforming science as it speaks back (Gibbons 1999).

Science produces reliable knowledge, not in terms of objectivity, but in terms of what works for the relevant peer group. What works has

now acquired a further dimension in a shift from reliable knowledge to socially robust knowledge because knowledge must be contextualised and science must listen to what society speaks back. Socially robust knowledge is valid both inside and outside the laboratory. This validity goes further than the relevant peer group and involves an extended group of experts and lay-experts. Since "society" has participated in the making of this socially robust knowledge, it is less likely to be contested than reliable knowledge (Gibbons 1999, Nowotny, Scott and Gibbons 2001).

In the new system, knowledge will no longer be superseded by superior science, but rather it may be sharply contested, and it is no longer within the control of scientific peers. This involves renegotiations and reinterpretations of dramatically extended boundaries. Science can no longer be validated as reliable by conventional discipline-bound norms. In order to become robust, science must be sensitive to a wider range of social implications (Gibbons 1999).

One outcome of these changes is that the problems are now formulated and negotiated in the agora – where science meets the public and they speak to each other – rather than in the university, industry or in government. Media is increasingly active in the agora, and here new communication technologies play and important role. The contextualisation occurs in the agora where today's societal and scientific problems are framed and defined, and their solutions are negotiated. Thus, the role of the scientific expertise, which has been so important in decision making, is changing as expertise spreads throughout society and splits up the established links between expertise and decision making/management (ibid.). The authority of science will need to be legitimated again and again, and to maintain this, science must enter the agora and participate fully in the production of socially robust knowledge (Gibbons 1999, Nowotny, Scott and Gibbons 2001).

Method

The analysis presented in this article is mainly based on qualitative interviews with five Norwegian policy makers in the Ministry of Education and Research (UFD) concerned with implementing computing in primary and secondary schools and four politicians representing four different political parties in the UF committee.[1] The interviews were conducted during spring and summer 2000. During the interviews we talked about the decision makers' ideas about implementing computers in secondary schools and the fact that girls have been regarded as not as competent and eager as boys in front of the computer. Additionally we talked about the decision makers' knowledge base on the issue, where they gathered their information from and what kind of research they used

to form their decisions. Previous to these interviews I had analysed several white papers from the Norwegian government and their programmes on ICT in education for the period from 1983 to 2000.

Application of research to solve the "girls and computing" problem

Organisation

The different ministries review questions and develop suggested solutions on behalf of the government who in turn present these cases for the parliament. Then, the different committees make a proposition, which makes the fundament for the negotiations in the parliament on allocations of funds and new laws. The aim in this case is to allocate enough resources to ensure better access to computers in schools. The general tasks for the ministries and the parliament have a special focus on allocation of funds. It is thus obvious that the decision makers' need for knowledge is oriented towards numbers they can enter into the equation for distribution.

The political information need is first of all covered through information from the ministries. But the politicians can also base their decisions on additional results. They invite special interest groups like the teacher union, groups of parents in the primary and secondary schools and others to voice their opinions.

The members of the UF committee have generally little knowledge of the subject since girls and computing has not been treated as an issue. They support their decisions regarding girls and computing on knowledge they regard as parallel, a point I will return to later. The ministry is to a larger extent than the politicians expected to posses expert knowledge on girls and computing. The Ministry of Education and Research is organised in different special departments along with an Equal opportunity secretariat that is supposed to provide insight for all departments and make sure every one considers the equal opportunity perspective. Even though the Equal opportunity secretariat possesses broad knowledge on what equal opportunity can be and how to implement equal opportunities, it seems like 50/50 distribution of boys and girls is the easiest and most applicable way to understand equal opportunities. In the same way as decision makers find it hard to translate qualitative research into practice, it seems hard for the Equal opportunity secretariat to accomplish anything but a goal of 50/50 distribution within their decision field.

As I have shown, the organisation of the parliament and the ministries is directly aimed at applying knowledge and gather

information which should be transmitted simply and directly within the ministries and to the decision makers with specific needs. Still, there might be aspects with this organisation that leads to research results being overlooked, or applied in such a manner that they do not cause direct effects. The topic for this article is not the potential organisational problems, but rather the constructions made by the decision makers. I will therefore in the next part examine further the decision makers and their knowledge base.

The decision makers' knowledge base

All of the public administrators in this case have some sort of previous connection to the educational system that make their competence interesting to the ministry. They have previously worked as teachers, school managers, in municipal administration of education or with the development of means of education. Some of these have their education within natural sciences, while the consultant in the Equal opportunity secretariat is a sociologist. Among the interviewed politicians in the UF committee one is an economist, two are trained teachers in language and history, and one of the female politicians is trained as project secretary in addition to having a degree in computing from 1989-90 (when actually quite a few women found computing interesting). The decision makers' background and trade is thus relevant for their work on education in general. In order to handle special issues within education, like girls and computing, they have to look to research.

The economist in the UF committee prefers to rely on quantitative research result, numbers, which he considers as solid facts. He dismisses qualitative research results, narratives, as hear-say because he finds that the social sciences have not developed reliable methods. The economist has more confidence in the quantitative research methods due to their system of excluding foolish answers and discovering false answers from the informants.

The sociologist in the Equal opportunity secretariat on the other hand claims that it is important that sociology looks into the matter, and she mentions several qualitative research findings to prove her point. The other decision makers are to be found somewhere in between these two stands in regard to what is considered important research. Most of them deny relying more on numbers than narratives in their decision making, and that they perceive narratives as less scientific than numbers. However, their choices and interpretation of the relevant research shows another picture.

What do the decision makers read out of the research?

> *I base my decisions on the available research for the current issue. Some of it is old, some of it new. Some of it is very narrow and to the point, and some of the research is very broad* (Politician in the UF committee).

The public administrators apply research systematically in their work and order reports from central research institutions. Knowledge regarding girls and computing is gathered through the Equal opportunity secretariat. In addition, public administrators spend time on the Internet to search for information, they investigate what the universities produce, examine the newspapers, and try to participate in national and international conferences. They consult with colleagues in other countries and read relevant journals. This seems as a thorough and active search for and effective internal distribution of relevant research results since the same selection of research reports are continuously mentioned by the policy makers.[2]

During the interviews the decision makers constantly referred to "research shows" and "(foreign) experts claim". This demonstrates the important role research plays in their knowledge base and as authorised facts. Why and to what extent research is applied, and how the research findings are interpreted is still far beyond the control of the researcher.

Most people in Norway seem to agree on the importance of computing as a useful tool for everyone. It is thus regarded as a political problem that research shows that not all citizens have access to or know how to use a computer. One of the politicians meant this problem would solve it self eventually, but in the mean time she argued for the importance of schools as the great equalisers in making everyone friendly with the computer. Further, computers are regarded as important because the Internet offers easily accessible information, a feature which especially girls are perceived to prefer. Public libraries should therefore have available computers to secure access for everyone.

The claim that it is crucial to be familiarised with computing at an early age is seen as the main findings of the research, at the same time as they point to British experts' concern over this early introduction to computing. Computing is regarded as both important and "dangerous" at the same time. In some aspects computing is seen as dangerous and in others as purely positive for the users. This goes to show the problems that arise from perceiving "computing" as a uniform and unambiguous technology. Additionally, research which reports that the pupils often are better than their teachers at computing, and that men still dominate the computing industry and higher education in computing causes concern.

Research is thus said to show that it is important to focus especially on girls and women because they have been engaged in computing to a lesser extent than men. There is also a widespread notion that girls "do not want" to learn computing. An IBM research report from 1999 apparently shows that Norwegian girls spend less time on the Internet and computing in general than their sisters in the other Nordic countries. The fact that Norwegian boys also spent less time than other boys in the region is hardly mentioned, and it does not contribute to adjusting the notion of the reserved girls. It is also a paradox that computing skills and interest is measured by numbers of hours spent in front of the computer. When comparing girls' and boys' computing, the common interpretation of research is that the more hours spent in front of the computer the better. On the other hand, there is widespread fear that the children will grow up as antisocial creatures because they spend hours alone in front of the computer. This fear is totally absent when decision makers express concern due to research reports showing that girls spend less time (= are less interested and competent) than boys in front of the computer. It is also a paradox that no one voices the alternative interpretation that girls might be better than boys at computing and therefore do not have to spend hours in front of the computer in order to finish their tasks. Additionally, when qualitative research results on girls and computing show how different the girls are from each other, this is often interpreted according to the quantitative notion of two opposite genders, and girls are thus seen to be better at the social and communicative parts of computing than boys are.

The decision makers claim that in comparison with other countries they find large differences between Norwegian girls' and boys' competence in natural science subjects. Most decision makers think this also applies to computing. They also read into the research reports that girls are communicative while boys approach the technology differently. Communicative use of technology is implicitly perceived as subordinate when the goal is perceived as 50/50 distribution of girls and boys in higher computing education. It is also possible that different applications of computers are seen as almost irrelevant, as long as girls are out-numbered in front of the computers and in hours spent computing.

My assertion is that this narrow but seemingly all-embracing and universal understanding of the term "computing" that is seen in almost all interpretation of research reports and in the decision makers' knowledge base, stop them from seeing alternative notions of what computing skills could have been in primary and secondary schools and how this is best implemented for everyone. Additionally the difference between boys and girls is stressed in these interpretations rather than focusing on the narratives which emphasise the diverse gender and the

differences between boys and between girls. It seems as the qualitative findings are overlooked and all power is granted to the quantitative research on the problematic girls and computing relation.

Numbers are easier to remember

Most of the decision makers are uncertain whether the figures are any better in other countries. This goes to show that figures reveal and pinpoint problems:

> *I don't know if girls and computing is a problem in the rest of Europe as in Norway because I haven't seen any research statistics on that* (Politician in the UF committee).

Further, the number of female teachers in primary and secondary schools causes concern among the decision makers. This is because these women lack computing skills and interest, and because male teachers are more or less absent on this level of education. The male dominance in the computing industry and education represent other numbers that give the decision makers reason to worry along with the focus on lack of sufficient computing equipment in schools.

Polarisations and presentations of differences between few and simple categories seem most interesting and easiest to read out of the research reports. Gender is thus a natural category to focus on because gender is perceived relevant in connections with computing and because gender is seen as easy to "measure".

Policy making is described as a mixture of exactness and trends, and it seems fit to argue that the decision makers perceive numbers as representing the exact while narratives represent trends, and thus are granted less authority because they are seen as less scientific.

> *If qualitative research is based on other research on facts, that is not to be despised. A lot of research can be conducted based on previous research on facts. You can for instance conduct a relatively narrow survey, and apply the broad material together with your own narrow population and make other issues and conclusions. So I don't see any reason why everyone should do research on everything all the time. We do after all have good access to facts that can be applied in many aspects* (Politician in the UF committee).

Decision makers claim they base their decisions on research reports because good research is their best aid and because research is said to provide answers for the future. In the case of girls and computing there is seemingly no controversies which call for the need of scientific expertise to settle arguments with authorised facts. The research seems to produce and make available knowledge on youths and computing that legitimises

the allocation of more funds to computers in schools, and thus continues to stress the difference between boys and girls and the idea of a necessary 1:1 relation between pupil and computer in order to learn anything.

Despite claiming that numbers and narratives are of equal value, many of the decision makers admit that quantitative research results are better because they need to apply figures in order to focus on how computing can be implemented for everyone.

> *In one way you might say it is easier to make generalisations based on the figures. When you are to make a political decision you ask if there has been any change, can you say anything about the figures. That can be difficult with the qualitative research results. You may lean on positive effects in this and that school, but usually you need the figures as support as well. If the one research supports the other, qualitative research is fine. We need both, but we often see that for instance gender studies apply qualitative methods, that is smaller research, and it is not easy to make generalisations from those to go for the entire society. Even though they supply important knowledge, we also need the quantitative research results. The research conducted by SSB is very important. Everyone likes it when, here we have conducted a national survey where all schools have participated, and where we can see that 27% this and 60% that. In order for a need to be specified and treated we need its numbers* (Public administrator in UFD).

In addition, policy makers often dismiss qualitative findings as hear-say anyone can make up on their own. If this "hear say" is in line with the policymakers' own experiences they are inclined to use the qualitative research results as support for their own opinions in discussions with others. If not, qualitative research is brushed off because of its lack of connection to facts (that is: numbers). Qualitative research is perceived as small scale research. Further, most decision makers constantly stress the weaknesses of qualitative research, such as the narrow choice of population, a wrong problem focus and lack of generalisation effects. No one raises a single, critical question towards quantitative research nor the interpretations and applications of numbers.

Several of the decision makers tried to give me examples of relevant qualitative research results that obviously are quantitative.[3] Some of the decision makers claim that they actually apply narratives because girls and computing is seen as difficult to describe in numbers. And they also point to the fact that the numbers are based on assessments that apparently make the research more qualitative, or put in other words, maybe of higher quality? Research on the competence of teachers and

available teaching aids is said to be just as important as research on numbers of computers in schools. The previous is described as qualitative features and research on the topic is therefore considered qualitative. Over all there seems to be little room for the actual qualitative research results.

Big brother and little sister as competitors for attention

The decision makers have a hard time separating properly between qualitative and quantitative research. Decision makers and often the general public as well construct quantitative research results as more scientific and hence more true and based on facts. Qualitative research on the other hand is perceived as focusing on the quality of a phenomenon, predicting trends or as the little sister of research on facts. The little sister is younger and not as wise as the big brother and has less capacity to take on large tasks, and hence she is granted less power and authority. The decision makers are not researchers and can therefore not be expected to know the differences between qualitative and quantitative research methods. None-the-less, their construction of quantitative research as big brother and qualitative research as little sister has fatal consequences for their choice of knowledge base.

In this regard, it is also interesting to note that the decision makers refer to quantitative research results using the names of the powerful institutions like SSB and IBM, while qualitative research results often are referred to by using only the first name of the specific researcher, like Dagny, Bente and Tove. Numbers might thus be granted more credibility because it seems as an entire research institution has produced the research while the narratives are too tightly connected to one, usually female researcher. Since the decision makers to a limited extent know the differences between qualitative and quantitative research (but still construct quantitative as "more scientific"), the numbers of researchers perceived to be responsible for the research may be a determining factor when it comes to reliability. Additionally there seems to be an unfortunate connotative link between the sex of the researcher, critical research conducted on gender and the preferred social scientific methods applied - that most of the qualitative researchers on gender issues literally are little sisters who are not conducting "real" science since they often apply qualitative methods. As seen in the quote of the public administrator above "*…we often see that for instance gender studies apply qualitative methods, that is smaller research…"* that can not compete with big brother's "real" science.

Personal experiences as knowledge base

Information on new phenomenon and problems must be delivered through numbers. Without such "facts", decision makers refuse to believe, for instance, that female-related or -generated websites on the Internet have become a success. But it is likely that the decision makers would have talked about the successful female websites if their own daughters had told them that they regularly visit such sites when surfing the Internet. Personal experiences and experiences of family and friends seem to be just as valuable as research results in the decision makers' knowledge base.

Some decision makers admit lacking information on girls and computing. Especially in the beginning they had to rely a lot on personal experiences in order to focus on how to implement computing in order to take girls' best interests into consideration. Officially, to a large extent the decision makers base their decisions on relevant research. Still, just as often as they mention research results, personal experiences or observations of their own children in front of the computer is mentioned.[4]

Several of the decision makers told me that their daughters were instrumental towards computing and that they showed little interest in the computer, in accordance with the traditional perception of girls and computing. Some of the daughters were considered as interested in computers due to a fascination in computer games like Pippi Longstocking. One of the decision makers told me that his two daughters and one son had altered his view of girls and computing. In his family the girls were more interested in computers and had greater competence in using them than the boy. Another of the decision makers experienced that technology oriented families served as inspiration for girls. Yet another elaborated on the observations she had made during visits to good friends in a poor European country. She was very impressed with what can be achieved with little money, and concluded that lack of money opens up for creative implementing of computers.

Several of the decision makers applied their experiences from their studies or from their workplace as a knowledge base for considerations and decisions pertaining to girls and computing. It is interesting to note that most of these experiences hold women as the most eager and competent computer users while men are seen to be less competent and more afraid of asking for assistance.

Personal experiences and observations thus play a considerable role in the decision maker's knowledge base. Isolated and casual "qualitative research" conducted by the inexperienced "decision maker researcher" seem to qualify as important arguments in the debate on girls and computing, while qualified narratives which to a large extent show

the same tendencies as the aggregated casual narratives, are diminished due to lack of universal value and reliability. It is a paradox that the qualified and casual qualitative research results show the same tendencies: when it comes to computers, girls use and comprehend computers differently, and many of them are indeed clever in understanding them and fascinated by their use and potential. Still, the official perception and the attempts to solve the problem are aimed at rescuing the scared outnumbered girls in order to reach 50/50 distribution in front of the computer.

Parallel fallacy

The UF committee has not treated girls and computing as a special issue. UFD is concerned with implementation of computer into schools in general. This might explain why the decision makers to such an extent need to rely on personal experiences rather than research. At the same time, they consider research results as an important base for decisions since they constantly refer to research from a field perceived as parallel to, or maybe even as the same problem – girls' problematic relation to natural science subjects. Compared to other countries there are large differences between boys' and girls' knowledge of natural science. Most decision makers think the numbers are about the same for computing. One of the decision maker's daughter has a Ph.D. in natural science, and she has had a hard time fighting her way. Based on her experiences, her father concludes that girls are afraid that computing is related to natural science, and thus choose to not study computing. The option to do something about this alleged misconception is not mentioned by any one of the decision makers.

As shown previously the decision makers rely heavily on numbers. For instance, they do apply quantitative research on attitudes where the numbers show that girls are more negative towards mathematics than boys are. The numbers show that girls are more or less absent, both in computing and mathematics. The decision makers draw from this that the same reasons are causing girls to be outnumbered - girls' fear.

The problem in focus might have been another one if we had measured something besides the numbers of girls versus the numbers of boys in the different subjects, and we could have avoided what I call a parallel fallacy. Numbers that show the same differences seem to mislead the decision makers to believe the same causes are to blame. At the same time, their own experiences and notions of what is perceived as difficult also may lead to parallel fallacies. Several of the decision makers have experienced that computing as tool for office work is easy to learn. Programming on the other hand is perceived as very difficult.

They do not understand how it works and think that in order to become a computing engineer you need a lot more knowledge than they possess. Simultaneously, few of the decision makers have their degrees in natural sciences, and perceive natural science as very complicated. It is likely that all areas perceived as complicated are brought together and constructed as one arena that can be treated with the same means.

In addition to treating girls and computing parallel to girls and natural sciences, the decision makers rely on general knowledge on traditional gender roles found in different reports. They assume that the same traditional division also applies for computing. Their perception of traditional divisions imply that girls are scared and afraid of trying new things, and that boys are nasty bullies who force the girls away from the computers. The repeated countings that presumably show that girls are outnumbered are interpreted in terms that construct girls as passive victims who do not see what would be in their own best interest.

In several contexts where girls are outnumbered, for instance in top positions in private enterprises, one of the reasons might be suppression and exclusion of girls due to male dominance which excludes girls from interesting positions. We can not automatically draw the conclusion that the same suppressers and strategies of exclusion are at work when the numbers show the same tendencies in front of the computers in primary and secondary schools. Quantitative research has detected unwanted differences between boys and girls through repeated surveys. Public statistics have always played an important role in public decision making. Numerical information is continuously becoming an important resource in decision-making and is a means to be granted more attention (Lie and Roll-Hansen 2001).

Such facts are perceived as unnegotiable, and no one seems to be critical towards the origin of the numbers or what they actually can tell us. When numbers are given such a large role in setting the agenda, research might actually work to conceal facts. The decision makers continue to base their decisions on numbers that describe girls as one homogenous group in contrast to a corresponding group of boys, despite all the qualitative research reports which show that the category "girl" includes so many different and heterogeneous human beings who should not be placed in the same box and that computers are used and interpreted very differently. Thus this contributes to concealing other differences which might have been relevant in order to solve the problem.

Large potential for better application of research on the problematic girls and computing relation

One of the decision makers found it very hard to answer whether and what type of research she applied in her work, because she found so much research to be biased. She claimed that such biased research would not go far within the policy making, but she found it hard to rely on research when the results often are contradicted by other research findings, or when the researcher only has focused on one aspect of the matter in question. In addition, she claimed that many apply research like the Devil reads the Bible or only apply research when it supports their stand.

In a perfect world, all good research would have been applied instrumentally to solve problems, and to inform and make decision makers and society in general more aware of the issue, and society would speak back to science. The political system and the public administration is far from part of a perfect world and much more likely to be parts in a strategic game:

> *I base my decisions on The Curriculum, some on research, some on the possibility of being part of a majority in order to actually do something. There are several aspects* (Politician in the UF committee).

One of the politicians in the committee admits that personal experiences are crucial for the choices she makes of reliable research:

> *The research I've read is mostly conclusions on... there are a lot of numbers there... but the conclusions, the summaries, more or less go along with my own experiences. And that is maybe why I choose to apply it as well (smiling). There is a tendency that we find research that supports our experiences and beliefs* (Politician in the UF committee).

One of many aims for the actors in this political and administrative game is to implement computing into secondary schools in a way that makes girls interested, and thus full equal opportunity can be achieved. They are searching for the good and effective decisions to solve the problem with absent girls. Since social science research, and especially qualitative social science is perceived to be scientifically questionable by many, decision makers are more likely to make use of quantitative research results which are perceived as more natural scientific and hence more true. Qualitative research results that claim girls do not act as one homogenous group in front of the computer might also be easier to dismiss because they make the process of decisions more complicated. To a certain extent it might seem as the decision makers are too quick in

their decision making, relying on insufficient, or what they perceive as parallel, information. Some of the decision makers do apply research results instrumentally, but mainly numbers, which have not been especially suitable for solving the girls and computing problem since it is still regarded as a problem 20 years after being put on the agenda. In some cases, the decision makers apply research results strategically to prove their point. To a certain extent, some of the research is only applied symbolically to convey a notion that they are aware of the problem and are trying to solve it. Many of the numbers contribute to putting items on the agenda and thus function as a concealer for other problematic areas.

Despite the organisation of the public administration and the parliament in order to gather information from relevant research and apply this in their decisions, I have shown that choices of information have a certain bias. To a certain extent some of the decision makers claim to reject research because they find it not to be of high enough quality or that it is conducted wrongfully. These are important aspects of quality, but as shown previously, the decision makers are not trained to make such evaluations and thus make mistakes, or, as a paradox, conduct their own casual qualitative research.

One of the main reasons for overlooking relevant (qualitative) research results on girls and computing is likely to lie in the cultural differences between the users and the researchers. The user translation of qualitative research results makes it appear as little scientific. This is an important aspect the qualitative researchers need to consider in their future work, for instance by making more generalised conclusions, disseminating their findings in a more interesting and comprehensible way, and positioning themselves together with large and well-known research institutes, in order to gain more reliability. Quantitative researchers, on the other hand, should make efforts to disseminate their analysis of the numbers rather than the numbers themselves, in order to guide the decision makers to professional interpretations of what the differences between boys and girls indicate and what might cause the differences.

At the same time, policy decision makers are facing important challenges to become more aware of the weaknesses of quantitative research, to become more sceptical of the numbers, and to learn to understand the numbers and place them into context. They should also become more aware of the advantages of qualitative research. But the world is not that simple, anymore.

Controversies are seen to mobilise scientific expertise, but in the case of girls and computing there is seemingly an idyllic lack of controversies. This opens up for more individual interpretations by the

decision makers, and they can apply research on the differences between boys and girls to grant legitimacy to political goals and the means to allocate more funding to implementing more computers into schools in order to achieve 50/50 distribution of boys and girls in front of the computer.

Science aims to produce reliable knowledge and to communicate this to society, in this case mainly represented by the decision makers. The decision makers are delegated the task of translating the research results into action, and, thus, they have opportunity of whether or not to grant authority to the research. In their interpretations, narratives and qualitative research results are not taken into account and interpreted as reliable knowledge. Or, the main findings from the qualitative research — in this case, the fact that girls are heterogeneous in their use of computers as well as boys are, and thus should not be categorised in two opposite categories — are interpreted according to the traditional quantitative gender categories. This results in the binary construction that girls prefer the communicative aspects of computers while boys are more inclined to play computer games or investigate the technology.

According to the new social contract between science and society science is produced in a more open system which should contribute to making the reliable knowledge also socially robust. In the case of translation of qualitative versus quantitative research results on girls and computing, qualitative research is produced openly, inviting the user to validate and interpret the research, while the quantitative research is based on calculations and negotiations that are not usually open or available to the decision maker. The open process of the qualitative research process leaves it open for critique, while the final numbers from the quantitative research, paradoxically, are interpreted as authorised facts.

Society's ability to speak back to science and the erosion of stable categorisations and ideas of truth and authority should open possibilities for the qualitative research results on ambiguous understanding of gender and computers to become socially robust. Rather it seems like the complexity this opens up for lead the decision makers (and society in general) to search for order and simple systems of categorisations that stress the differences between the genders. Narratives are thus not constructed as socially robust knowledge because numbers are presented more systematically and as plain facts in a simple and easily comprehensible narrative.

In order to develop socially robust knowledge, science must also be sensitive to a wider range of social implications. This includes for instance the personal experiences of the decision makers and the system of information translation they must operate within. UFD needs to

accumulate and disperse knowledge. There is of course a limit to how much information that can be spread and accumulated, and thus we may observe a preference for numbers over narratives. But this has more to do with the presentation of the research results than the method behind the knowledge production. The same need for easy accessible and surveyable facts are also observed in the media and in the agora at large.

I have shown a variety of multiple explanations on how and why (not) research results are applied in policymaking and what kind of research is perceived to be reliable and trustworthy. What we clearly see is that decision makers seem to be seduced by numbers since numbers are seen as more reliable, socially robust or applicable than narratives. What we must avoid in the future is the narrow and stable categorisation of numbers versus narratives, just as girls are perceived in opposition to boys, and rather open up for varieties of gender and narratives as the new social contract develops.

Notes

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1 UFD was at the time of the interviews in spring and summer 2000 the Ministry of Church, Education and Research. After the election of fall 2001 the structure of the ministries was changed, and KUF was transformed into UFD, Ministry of Education and Research.

2 The most important research reports seems to be Guri Mette Vestby (quantified qualitative research on youth's understanding of ICT-concepts), Central Bureau of Statistics – SSB – 1995 (traditional quantitative survey on numbers of computers per school, number of hours spent in front of the computer per week for boys/girls etc.), Tove Håpnes and Bente Rasmussen 1997 (qualitative research on secondary school girls' use and understanding of ICT. This report is based on Gansmo 1998, Nordli 1998 and Kvaløy 1999), IBM 1999 (survey of distribution of computers and computer use in the Nordic countries), and SITES (repeated surveys of equipment and use in different countries). In addition, ITU at the University of Oslo is appointed main distributor of research on ICT in education.

3 For instance Berit Skog's *Analogue and digital teaching aids– pupils and teachers in the formation society*.

4 This is information the informants shared unsolicited with me. In advance I had not defined experiences of family members and friends as a source of knowledge/information. By asking open-ended questions and inviting the informants to share as much as possible of their experiences with me, I discovered this rather interesting paradox: that qualitative research results are dismissed in favour of personal experiences.

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LIMITS OF STATE FEMINISM: CHAOTIC TRANSLATIONS OF THE "GIRLS AND COMPUTING" PROBLEM

For more than two decades, the Norwegian Ministry of Education has been concerned with strategies to facilitate the inclusion of pupils into the Information Society. From quite early on, there was a particular worry that girls would be excluded from the use of computers. Thus, strategies were developed, which, in part, were general measures to implement ICT in the normal curriculum of primary and secondary schools, and partly measures aimed particularly at including girls.

The development of these inclusion strategies for girls has to be understood in light of the fact that, through the 1970s and 80s, the Norwegian government institutionalised several general feminist interests. It established several gender equality institutions, including the Ministry of Education's Equal Opportunities Secretariat, which has made a valuable contribution to the shaping of gender and ICT policies and related strategies that aim at getting girls included in the emerging Information Society. With Helga Hernes (1987), we might characterise this way of exercising the politics of equal opportunity as "state feminism". State feminism, as seen in Scandinavia, is a result of the interplay between agitation from *below* and integration policy from *above*, for instance, gender equality and social policies (ibid.). Girls and computing has not been subject to agitation from below. Generally, we might say that there is far less agitation from below now than was the case in the 1970s. There seems to be reason to question whether state feminism from above has generated an image among the general public that mobilisation from below is no longer necessary since we "have achieved sufficient gender equality" (through state feminism from above) in Norway.

This implies that Norway has a regulatory regime where we typically see attempts at top-down feminism through state gender equality policy (ibid.). The state feminism regime might thus be said to build on a diffusion or implementation model where the master (the Ministry) is a powerful institution that issues directives and orders to subordinates (the schools). In such an implementation model, the instructions are seen to be endowed with an inner force, which keeps them moving down the chain of action as long as there are no obstacles (Latour 1986).

Even though state feminism characteristically implies attempts at top-down feminism through the state gender equality policy, we must bear in mind that this is basically a "soft regime". The legal framework is

open-ended and few financial instruments are utilised. No, or only weak, penalties are imposed for non-implementation.

This article briefly describes the 20 year long gender and computing focus in Norwegian White Papers as a basis for investigating how the schools have acted upon these plans, and how they have translated the messages. I shall examine how the differences between these translations were constructed and what contributed to these differences through focusing on school administrators.

Gender and ICT policies in Norway from 1983 to 2003

The first White Paper exclusively treating computing in schools came in 1983; this recommended that the schools provide teaching in electronic data processing (EDP) and programming in addition to other subjects, mainly as an elective subject.[1] Ten years later, EDP was considered old-fashioned and replaced with Information Technology (IT). The new White Paper suggested that IT should be integrated in several subjects and not treated as a separate subject.[2] Three years later, communication was included in the concept of information technology. Information and communication technology (ICT) was seen as a natural part of all subjects; ICT should not be taught separately, but through making use of it in other subjects: ICT should improve learning in general.[3] The last plan, so far, covering 2000-2003, stressed the need to emphasise and develop pedagogical applications.[4]

Despite the acknowledgement of the rapidly developing technology, girls' reluctance towards computing has been considered quite stable over the same period. Thus, we might say that the absence of girls has been regarded as a problem for as long as computing has been regarded as the key to prosperity. The 1983 White Paper observed that girls were lagging behind and that most girls did not find computing interesting; the White Paper aimed to avoid new divides due to computing education. Nevertheless, it suggested no strategies for inclusion of girls, except stating as a goal that the teaching should be carried out irrespective of gender.

The 1993 White Paper pointed out that the manner in which new technology was applied could contribute to new gender divides. Boys were apparently most interested in the technical subtleties, while girls were more interested in useful application of computers. Thus, girls were seen to want knowledge about new technology, but also as applying this knowledge differently from the boys. In this White Paper, a strategy of separate groups for girls was suggested in order to stimulate use of IT in subjects typically regarded as feminine, and which make use of electronic communication in, for instance, foreign language studies. This

White Paper advocated a view of girls as not only lacking the (preferred) masculine IT-skills, but also as having developed a special feminine way of applying IT – which was characterised as communicative, useful and appropriate use of IT in full.

The Programme of action for 1996-99 claimed that being able to use ICT will become just as common as being able to ride a bicycle or swim; the goal was thus to reach everyone. In order to give both sexes from all social classes the possibility to gain knowledge and skills in ICT, the teaching and planning of this should take into consideration that boys and girls from different social classes have different needs and presuppositions. The last plan, covering 2000-2003, continues this focus, and adds that it is necessary to find ways to apply ICT that are appealing to girls. This is also done in order to recruit more women to ICT professions.

The development in computing notions from EDP via IT to ICT shows a development from a limited, specialist technology to a trivial, but apparently crucial technology for all. At the same time, we can observe a development in the connotations of the technology. In the beginning, computing was associated with interests usually seen as masculine, such as mathematics and science. Later, computing is seen to include typical feminine interests, such as communication. The teaching of computing has moved from integration into a few subjects to integration into all subjects, parallel with development in the comprehension of computing. Thus, on the policy level, computing can be considered as including everyone irrespective of class and gender, in principle. But, at the same time, girls' lack of interest in computing has been on the agenda in every White Paper and Programme of action that has been produced – the policy makers do not regard girls, in reality, as included.

Further, the White Papers observed that girls were taking an interest in computers in innovative, useful and communicative ways. Since girls and computing has been put on the agenda as a problem for 20 years and since the masculine "tinkering" competence is regarded as more important for future computer use and interest, feminine computer use is not perceived as "correct" use by either girls or policymakers (Gansmo 1998, 2002a and 2002b). Additionally, the White Papers stressed that girls lack access to computers due to, among other things, the schools having so few computers available. The goal is thus to increase the amount of computers available. The idea behind this seems to be that everyone will automatically be interested in computing, if they are granted access.

Thus, the main inclusion strategy seems to be to give everyone - with an emphasis on girls - access to computers, preferably through the

integration of computing in all subjects and by increasing the amount of computers available. In short, the implementation and inclusion strategies include:

- Access for all, girls included
- Computing integrated in all subjects
- ICT training for teachers, especially female teachers.

Since computing by now, according to the directives of the White Papers, should be integrated in all subjects in all schools, the technology is perceived as including everyone - even girls, as long as they are granted access and provided with information about the necessity of computing, preferably from female role models. These are inclusion strategies produced mainly at a national level, based on policy-makers' comprehension of computers and gender (Gansmo 2002a).

The national policy towards girls and computers, and the intended inclusion strategies, may be conceived as an outcome of a state feminism, which is characteristic for the Scandinavian countries. Thus, to analyse the way in which individual schools react to, or are translated into, the policy is a way of assessing the efficiency of state feminism as a kind of meta-inclusion strategy to get more women into Information Society technologies. The translation model of actor network theory has an explicit focus on the rhetorical features of the way that statements about the world are performed through a chain of actors/actants.

Translation problems of state feminism

As indicated above, state feminism can be said to be built on a diffusion or implementation model, where the Ministry issues directives that the schools are expected to implement. Such an implementation model has the advantage that everything can be explained either by talking about characteristics of the initial force of the instruction, or by pointing to features of the receiving or resisting medium. In other words: when an instruction is faithfully executed, the master (or Ministry) is said to have a great deal of power, when it is not, one can merely argue that the master's power was met with resistance (Latour 1986). Bruno Latour (ibid.) maintains that, either, you simply have power in theory, which means that you do not have it, or, power is demonstrated through the practice of others, which again means that you do not have it, as the power is demonstrated by/through those performing the given action. Power is thus not something one can possess; it must be treated as a consequence rather than as a cause of action. No matter how much power one appears to accumulate, it is always necessary to obtain it from others who are carrying out the action. Rather than an implementation model of power, Latour thus suggests a translation model, where power

is composed by enrolling many actors. According to the translation model, the spread in time and space of an instruction is in the hands of the users, and they may act in different ways. They may overlook it, modify it, deflect it, betray it or carry it through in some way. Further, displacement is not caused by the initial impetus, since the instruction is seen to have no impetus whatsoever; rather, it is the energy given to the instruction by everyone in the chain who does something with it. Additionally, each of the members in the chain is not simply resisting a force or transmitting it in the way they would in the implementation model; rather, they are doing something essential for the existence and maintenance of the order of the network or system. This means that rather than being made up of passive receivers, the chain is composed of actors, who shape the instruction according to their different projects. Hence, the label "translation" - the instruction changes as it moves from hand to hand (Latour 1986).

Michel Callon (1986) suggests that translation is a process before it is a result, and four "moments" of translation can be discerned in the attempts by the policymakers to impose themselves and their definition of the situation on the other actors. During this translation, the identity of the actors, the possibility of interaction and the margins of manoeuvre are negotiated and delimited. Even though the moments are described separately on paper, they can, in reality, overlap.

We should note that Callon's translation model has the work of scientists as its point of departure. The model describes the challenges scientific factual claims are facing in their travel to become accepted as facts or rejected as misleading. Latour (1987) shows how the translation model may be valid in the analysis of how technological innovations may or may not be diffused. Usually, policymakers are perceived to be different from scientists and engineers, since their activity clearly is embedded in values and interests. However, this view overlooks the fact that policymakers are social innovators. In my case, I believe that policymakers may be treated as equivalent to Callon's researchers, just as his scallops can be equivalent to my computing, and his fishermen maybe to my school administrators. All of them are involved in the construction of a socio-technology that builds on a combination of existing computers and state feminist gender ideology. What the policymakers in my case are trying to construct is a mix of facts and values, which Latour (1999) tries to describe by his concept of the factish. Thus, Callon's translation model should be adaptable to the case of the Norwegian "girls and computing" problem and a helpful tool to analyse it. In the following, I shall provide an outline of how the model may be applied.

The first moment of Callon's translation model is problematisation, or the process of how to become indispensable: the policymakers have, through their 20 years of focussing on "girls and ICT", tried to become indispensable to the other actors in the drama by defining the state of the problem and possible solutions. Through these White Papers, the policymakers have identified the other actors and their identities in a manner which established themselves as an "obligatory passage point" in the network of relationships they were building. Since the separate actors, the schools, the girls and the computers, apparently have not been able to solve or identify the problem on their own, the policymakers show that it will be in the actors' best interest to form an alliance around the obligatory passage point. They need to work together in order to reach the goal.

The second moment, interessement, or how the allies are locked into place, relates to the hypothetical aspects of problematisation. The policymakers try to lock the other actors into the roles and alliances proposed for them by the problematisation. But, each actor listed in the problematisation can submit to being integrated into the initial plan, or inversely, refuse the transaction by defining their identity, goals, projects, motivations or interests in another manner. These entities are also tentatively implicated in the problematisation of other actors as well, which means that their identities are defined in competitive ways. The policymakers thus need to build devices that can be placed between them and all the competitive entities that would like to define the actors differently. If the interessement had been successful, it would more-or-less confirm the validity of the problematisation, and thus achieve enrolment, that is, alliances which reject the outside, competitive definitions of them.

The third moment, enrolment, refers to a set of strategies where the policymakers seek to define and connect the various roles they have allocated to the other actors, who again, accept them. The enrolment can be described through the multilateral negotiations that enable interessement to succeed. The issue is to transform the questions in the problematisation into a series of statements that are more certain: girls do want to use computers, schools think it is important that girls are encouraged to use computers more and should accomplish this through strategy X and Y and so on. If the girls are to be enrolled, they must first be willing to use the computers "properly" and to accept the stable gender category offered to them. If the schools are to be enrolled, they must be willing to make gender inclusion efforts.

The fourth moment, mobilisation of allies refers to a set of methods used by the policymakers to ensure that the supposed spokesmen for various relevant collectives are properly able to represent

these collectives and are not betrayed by the collectives. Who speaks in the name of whom? Will the masses follow their representatives? These questions are important because only a few rare individuals are interested on behalf of the masses they represent, or claim to represent. Through the designation of the spokesmen, all actors are first displaced and then reassembled in a certain place at a certain time. This mobilisation is materialised through a series of displacements. The girls are transformed into a homogenous group; this group is turned into numbers; these numbers are turned into graphs and models showing that many more boys than girls make use of computers. The girls have been displaced and transported into the White Papers through a series of transformations. In the end, all actors end up being represented by the policymakers who speak and act in their name through the White Papers; the same goes for the schools. The policymakers claim to know what these entities are and want. These entities have been mobilised, they have been displaced from their homes to the discussions in the White Papers.[5]

The initial problematisation defined a series of negotiable hypotheses on the identity, relationships and goals of the different actors. At the end of these four moments, a constraining network of relationships has been built. But, the alliances that are implied by it can be contested at any moment, and thus, the translation becomes treason. Schools do not implement computing with gender inclusion strategies. More girls do not start using computers, or more girls do not start using computers in the "right" way, which means they do not become intensely fascinated and start tinkering with the technology the "preferred" way, which is defined in masculine terms. This is because, according to Latour (1986), displacement is the energy given to the order by everyone in the chain who does something with it. The different actors shape the order according to their different projects, and the order thus changes as it moves from hand to hand – it is translated. As the analysis will show, in the case of girls and computing, we might also ask who is translating who in this process.

Method

In order to focus on how schools have acted upon government instructions, their local translations of ICT implementation and inclusion strategies, the empirical data for this article is based on qualitative interviews with seven secondary school administrators, that is headmasters or deputy education officers, in seven different secondary schools. This means that I see the schools' translation through the eyes of

the administrators, through their own presentation of their strategic competence.

Six of the schools are located in a medium sized city in central Norway and have between 300 to 550 pupils in years eight to ten (ages 13-16). The seventh school is located in a small municipality neighbouring a small town on the west coast of Norway; the school has 150 pupils in years five to ten, (ages 10-16). All interviews were conducted during Winter and Summer of 2000 at the different schools.

During the interviews, the informants described their school and their strategy to implement ICT in the teaching, why ICT is important, what is regarded as problematic, how and if they apply the White Papers on ICT implementation, reasons for existing gender differences regarding computing, and what must be done to ensure gender equality in front of the computer.

All schools had access to some computers, on average at least one per classroom, and made use of them to varying degrees and in different ways. In the following sections of this article, I will show how the very different active processes of translation of the White Papers take place among the school administrators. I shall present different versions of these translation processes, and show that active translations might even lead to better results when "disobeying" state feminism instructions about gender inclusion strategies.

The aim is not to demonstrate that there actually are differences between schools; this has been done thoroughly already (see for instance: Gansmo 1998, Håpnes and Rasmussen 1997, Kvaløy 1999, Nordli 1998, Østerud et al. 1999). Rather, the aim is to show how the differences were constructed and what contributes to these differences.

Despite large differences among these schools, I detected three main stories in the analysis regarding the translation of the instructions of ICT implementation and gender inclusion. The first group of schools turned the instructions down due to lack of financial support for implementation of the instructions. I have labelled this group "The Resigned schools" due to their lack of alternative translations. The second group of schools worked with what they had and were actively seeking more funding or project participation. I have labelled this group "The Doubtful followers", because they partly followed the instructions while doubting the message. The last group is labelled "The Innovative schools" due to their innovative, but "disobedient" implementation strategy. All schools were given fictive names starting with the first letter of their respective category.[6]

The Resigned schools

The Resigned schools, here given the names Rødvik and Rugnes, have no implementation strategy for ICT and no strategy for including girls. They admit that they might observe a gender divide, but explain that they have so many other, more important issues to deal with, and they simply cannot follow all the requests from above due to lack of time, resources and money. Besides, they think that the digital and gender divides will diminish in due course because of the constant diffusion of the technology in society. In short, they report that pupils have better access to computers and better computers at home, that the pupils have better ICT skills than the teachers, and that they have no ICT pioneers among the staff, which in turn leads to no need for or possibility to offer basic ICT training to the pupils. They re-translate by denial.

The headmistresses at Rødvik and Rugnes report a considerable mismatch between the aims of the White Papers and the situation at the school; goals and promises stated in the White Papers, and by the municipality, bring about high expectations among teachers, pupils and parents regarding ICT implementation. Due to lack of funding and of ICT competent teachers, the school struggles to translate the aims into action.

> *The new plans from KUF (The Ministry of Education) and L97 (the national curriculum plan) which state as aims that IT should be a natural part of teaching in all subjects, this is just not an achievable goal. Yes, they paint a pretty picture, but they make two mistakes. Firstly, they are unrealistic because the programme is not accompanied by the necessary funding. You cannot accomplish everything they prescribe, not in terms of equipment, visiting museums, making field trips, and all that kind of thing. The bottom line is that you don't have enough money to do all of that. And the second mistake is that computing is pushed into too many fields. There is so much detail and it comes as directives. The slogan is: You must, you must, you must! I try to follow all the directives, but there is no way we can accomplish everything that they want* (Rødvik).

Elementary introduction to computing is not seen as necessary for the pupils since they have access to computers at home and are regarded as more computer-literate than the teachers. There are few and perhaps even no visions regarding how computing can be applied in teaching, based on the resigned claim that there are not enough computers available anyway.

Still, computing is seen as an option for all pupils irrespective of gender, and the schools have thus not found it necessary to make any

efforts to include girls in any way. Even though they have observed a gender divide earlier, they find that girls are becoming increasingly interested in computing without any special efforts from the school.

Thus, the Resigned schools have no gender inclusion strategies. The headmistress of Rugnes observed that boys are very keen on playing computer games. She is not certain how, or if, the girls make use of computers, but she thinks they are more interested in communication through the Internet. Games and Internet communication are regarded as OK as first steps on the ICT education ladder, but the learning must develop.

> *I have not been around in the classrooms to observe who uses what and how they use it, so I don't know whether boys and girls use the computer equipment differently. But, I do know they use it for their school assignments, and then I guess the girls spend a lot of time, on the Internet, on conversation groups or chatting or whatever it's called. And I'm not even sure that is of much value. The boys probably play a lot of games* (Rødvik).

> *There are differences between girls and boys in some classes, but the boys are not the only ones using the computers. There are a few girls as well, but it is mainly boys. It might be this 'sitting down and staring at the screen'; maybe it doesn't have the same value for the girls as for the boys. And I find no reason to say that this is wrong. We are different biologically, and why not be different value-wise or when it comes to different activities? That must be allowed as well* (Rødvik).

> *If you ask me, it is not a real problem that girls are lagging behind when it comes to computing. I've always meant that girls have exactly the same options if they could just be bothered. So I'm not particularly impressed with my own sex, generally. I have lectured a lot, and I have always been annoyed with the girls who made excuses saying that since they are girls, they can't do mathematics or science. It is not true at all! The options are equally much there, and I've never felt discriminated against or faced problems because I'm a woman. That's why I think it is a bit exaggerated; they have maybe driven the so-called struggle for equality too far* (Rødvik).

To not follow a gender equality strategy is chosen based on personal experience, and a dichotomous understanding of gender. Computing is seen as important in boys' interests but not to the same extent for girls. Since girls and boys by nature are different, it is regarded as natural and not problematic that girls are not interested in or included in computing activities. These assumptions about difference are not a result of the

headmistress' observations, but her experiences in other fields and what she probably sees as the general discourse about girls and computing, or girls and technology at large.

Thus, the headmistress of Rødvik reports "natural and unproblematic" gender differences among her pupils in their use of ICT. If gender differences are to be regarded as problematic, the problem is placed within the girls themselves, which should rather speak for gender inclusion strategies than against. But again, the lack of available computers is used as an argument that it is impossible for the school to include any pupil into the allegedly important and bright future of computing. The main message taken away from the White Papers is that computing is important. This message is understood by all schools covered in this study, but no one seems to apply the White Papers much further than stating the importance of computing.

Even though Rugnes does not have a gender inclusion strategy either, the headmistress notes that it probably would have been useful to have one, if the financial situation was different.

> *I guess KUF (The Ministry of Education) is concerned with girls and computing, maybe because fewer girls have immersed themselves in computers to the same extent as boys have. I do see that tendency here. But, I guess it is a bit the same with computers as with the other subjects, you know, the schools have tried for years to get pupils to make untraditional choices, for instance regarding home economics and arts and crafts. .... Rugnes has not focussed especially on girls and computing. First of all, we received these machines not long ago, and secondly, we've been mostly concerned with raising competence among the teachers, so that they can go ahead and make more out of it. So we don't have any specific plans regarding girls and computing. Plus, there are so many other directions to follow, both L97 (the national curriculum) and from the municipality. In this first round, we've been concerned with making what we have work well* (Rugnes).

Besides, the headmistress thinks that the gender gap is diminishing by itself; everyone is expected to use computers these days, and students, both male and female, are gradually introduced to all kinds of computing tasks and will thus learn how to apply ICT in due course. In the near future, most girls will become competent ICT users by necessity, and it is thus not of vital importance that secondary schools should make a lot of effort to include girls, according to the Resigned schools.

Rugnes is not particularly happy with the numbers of computers available, the level of ICT competence among teachers and the implementation of computing in schools. They have, on a few occasions,

tried to apply funding for computer projects, after receiving information from the municipality or the county, but they have not been among the fortunate ones selected for funding.

> *This might be due to us not having someone who's been, what should I call it, a lighthouse in terms of computer projects. This is important; if you have someone who is really glowing with enthusiasm, who really makes an effort, then you usually manage to get more out of it than if you don't have someone like that* (Rugnes).

As the Innovative schools will show, there may be a double gain from being at the forefront, and having computer pioneers or lighthouse persons working at your school. Those who have, will get more, and those who do not, will get nothing. This also goes to show the importance of networks and being the one who defines the obligatory passage point. The headmistress at Rugnes might thus seem resigned and passive towards the ICT implementation and gender inclusion strategies from the Ministry, but on the other hand, she also voices a scepticism none of the other schools seem to have:

> *It is frightening to see how vulnerable we become when everything is supposed to be computerised. You know, there are deadlines to follow, and suddenly the machinery doesn't work, and then you're stuck. In a way, I think we've jumped onto a runaway train, made ourselves too dependent. It might be old-fashioned to think like this (laughs), but I find it a bit worrying that we implement computing at any cost. We spend a lot of money on it. And if it is worth it, hm, that's hard to tell. You shall, you must, sort of* (Rugnes).

I have labelled these two schools, Rødvik and Rugnes, resigned due to their more or less passive acceptance of the public goals for ICT implementation and gender inclusion strategies with few or no attempts or ideas about how to carry out this work. Computing is regarded as important, but they do not have the means to implement the strategies handed down by the Ministry of Education. Gender differences and digital divides are observed, which in itself might point to their perceived relevance, but on the other hand, Rødvik refuses the notion that this is an important problem, at least in the context of a strained and busy school. Rugnes acknowledges that it is probably important to focus on girls and computing, but due to many other constraints and an impression that this will solve itself in due time, they do not give priority to attempts to follow up the instructions from the Ministry concerning inclusion strategies. Thus, at the Resigned schools, the translation process stops almost before it is started. The Resigned schools deny the problematisation.

The Doubtful followers

The second group of schools, the Doubtful followers given the names Domborgen, Drollvoll and Dresund, all offer introductory basic ICT courses to their year 8 pupils in order to secure widespread use of ICT in the different subjects. Their implementation strategy is to gradually provide teaching through ICT in the regular curriculum, but they find this difficult because of a lack of ICT-literate teachers. These schools also have a gender focus in their strategies, but no explicit girl-inclusion strategies. They observe some gender differences, but question whether it is really a problem.

Further, one of these schools experienced that pupils with learning disabilities might be included in the school by letting them lead the way on the Information Superhighway, and another observed that girls from ethnic minorities were included through access to Internet chat in their native languages.

These Doubtful followers of the White Papers and the national curriculum do try to follow the aims, but question their appropriateness and relevance. At the same time, they also read the White Papers in order to find options for seeking more funding through suggested or ongoing projects.

> *It might be our own fault, but we know too little about what KUF (the Ministry of Education) says, and what's in the action plans. I find the information insufficient. We have seen plans, you know, and we do know about stuff, but mainly we've been working on developing our own interests, independently of KUF's directions* (Domborgen).

> *IT is important in school because IT is here to stay, and it develops rapidly. So, we can't just sit there and say this is worrying and this is difficult for us. We just have to be oriented towards the future. I don't think there is one single job where we don't come across computing. So, we just have to give it a go* (Domborgen).

ICT is one of several endeavours in Domborgen's plans where they focus especially on technology and design. Since they do not know the computing level of their new pupils, the two first weeks of year 8 are used to give them an introductory course in computing. Since ICT is part of their teaching in natural science and most subjects, except physical education, the pupils are supposed to learn it gradually. Further, the school tries to implement ICT in ways that the pupils find interesting and exciting. A tendency was observed to use the school's home page and e-mails to slander teachers and other pupils. Instead of policing the pupils' ICT use, the administration asked the pupils how they would like to

apply ICT. In an attempt to change the negative aspects into something positive, the pupils were allowed to organise a computer slumber-party at the school. Thus, Domborgen tries to include the pupils through elementary introduction courses in ICT, and through inviting the pupils to become rational and responsible computer users by granting them "responsible freedom".

The second Doubtful school, Drollvoll, stresses the importance of computing courses for teachers, focusing on how to make use of ICT in the subjects, rather than the more commonly offered training in the use of software. The main obstacles perceived are lack of overarching plans for the ICT training of the teachers, lack of available computers for the teachers, and thirdly, lack of ideas for and training in how ICT can be implemented in the subjects, in the teaching. This, and the fact that teachers lack access to computers to tutor themselves at home, makes computers seem like glorified typewriters. Drollvoll's deputy education officer suggests solving the problem by teaching ICT as a separate subject in school in order to give the pupils the basic knowledge they need, which will enable them to make use of computers in the subjects.

Drollvoll's ICT-implementation strategy as it is today, rather focuses on the compulsory 10-hour introductory course in year 8, where all pupils learn basic wordprocessing, presentation programs, use of the Internet and e-mail. Further, computing is to some extent expected to be integrated into subjects like arts and crafts, thus providing all pupils with some ICT competence. This absence of choice is Drollvoll's only attempt at an inclusion strategy for all pupils, girls included. They do however observe, like Dresund, that especially girls were included through extracurricular use of the Internet. Particularly some Vietnamese girls were seen as included due to their interest in chatting on the Internet in Vietnamese.

The (unintended) success-story of the third Doubtful school, Dresund, is their ICT project for pupils with learning disabilities. Four boys with learning disabilities were given ICT training at the university. These boys were active participants in designing the project, and their ICT competence was regarded as a resource for and by the other pupils. In this way, ICT can be used to include pupils with learning disabilities in education and social networks, because the other pupils appreciated being given access to the computer "glass room" in the middle of the school building with these pupils, and because ICT competence is highly regarded.

Dresund prefers pupils to be allowed free access to computers and the Internet on their own, as long as they do not do anything they would not want a teacher catch them doing. Thus, the pupils were given free access in their breaks between classes to keep them from vandalising

school property. The pupils took this opportunity to download games and chat programs from the Internet. To the annoyance of the municipality and the school's telecom provider, this slowed down general traffic, and they demanded that Dresund restrict the pupils' use of Internet services. This has caused fewer girls using the computers because they can no longer use the Internet to chat, and several pupils have returned to the undesirable behaviour the computer initiative was intended to prevent. Thus, extra-curricular use of computers, which often means surfing on the Internet or chatting, might be regarded as an effective inclusion strategy for girls because they actually made use of the computers when this was allowed.

Domborgen's activity plan states that computing is important for both boys and girls, because the school wants to reduce the gender gap. They have no explicit strategy with which to achieve this, but believe that motivation through explaining how central and important computing will be in the future, is the right way to go. Like the headmistress of Rugnes, the headmaster of Domborgen believes that the girls are slowly catching up, but it is important for them to make the girls participate because gender equality is seen as important, especially regarding future job opportunities. Thus, Domborgen tries, through what they call binding efforts, to engage all girls and boys and make them responsible, so that no one can resign.

> *We make both boys and girls responsible for participating through having a binding effort on this, and thus nobody can drop out. But, it is important that we involve everybody, and we found it necessary to mention this about girls. It shouldn't be necessary today, but experience gives a different message. We could, of course, say this is a school effort, but I guess we wanted to underline that it is just as much the girls as the boys. To make everybody responsible in this, and maybe give the boys some responsibilities too, to make them conscious about involving girls, to make sure there's no difference* (Domborgen).

> *I don't see any differences between boys and girls in the way we use computers now. The girls are just as eager to ask for permission to use our machines. But the boys dominated the computer slumber party. The boys took the initiative and organised everything. That's a paradox. Why don't any of the girls start something like that? But of course, when we let the pupils loose like that, the gender differences emerge. Because it wasn't guided by any adults at school, it was run by the pupils, and then the differences emerge again. Even though some girls participated, it was dominated by*

> *boys. So in terms of this computing thing, there are still gender differences. That's obvious* (Domborgen).

Competence in computing and technology is a personal responsibility when the schools have provided all pupils with access and opportunities. But boys are especially responsible for including the girls; girls are not fully able to take responsibility for themselves and must be guided by either boys or adults. Even though the headmaster of Domborgen reports that the gender divide is important, he claims that they do not observe much difference between boys' and girls' computer use in school. The gender differences in (extracurricular) computer interests are explained as biological differences based on a dichotomous understanding of gender. The headmaster of Domborgen points to problems involved with giving girls and boys the same opportunities without turning them into a single androgynous mass.

> *The gender differences are imposed from birth. ... Well, I'm no expert on tendencies of development; I just merely state the fact that it is still like this. We must try to act to do something about it, at least if we think it is important. And that's the big question really. Something must be wrong if they don't have the same opportunities when they enter the labour marked. We must provide everybody with the possibility to be equal. But when it comes to fields of interest and such - of course we don't want everything to drift, so that boys and girls become the same. The gender differences are there, you know. This is a dilemma. And maybe we need to be more conscious, let everyone cultivate his or her own peculiarity and culture. But simultaneously, we need to be more conscious when it comes to choice of trade, having the same opportunities in school* (Domborgen).

Girls and boys are seen as essentially different and must be allowed to be different, but they must also be allowed the same job opportunities. As is the case with the importance of computing, gender equality is primarily tied to future job opportunities. Just as few of the schools talk about the importance of computing in subjects, as a tool for the present learning situation, they do not talk about gender equality in school, maybe except for the allegedly important 50/50 distribution in most subjects. Arguments using the "because it is good for you" methodology have hardly ever been motivating for most people. On the other hand, Domborgen reports successful implementation of computing in subjects where they can scan pictures and gather information from the Internet, which means that they, to some extent, use the computer as an (in)direct tool for learning.

Dresund notes that the scarce computer resources are occupied mostly by boys, and believes that better access will reduce the gap between boys and girls. To remedy the gender gap, boys or girls have first priority on the computers every second week in their breaks when they are allowed free access to the computers.

> *I will not hide the fact; girls are not as interested in computing as the boys. We have organised it so that the girls are left with no choice; they cannot choose not to do computing. But actually, I'm observing a tendency right now, that girls, at least when it comes to e-mail and chat, are almost overtaking the boys. One night a week, our computer lab is open to everyone. They can come and use the Internet, and the software we have. Those nights, I won't say girls are predominant here, but - the girls are usually chatting on the Internet those nights. And it seems as if the language minority girls, especially the Vietnamese who have a Viet-chat, a special channel in their mother tongue, they use it a lot. The boys are also very eager to use the Internet. On these nights, it is really mainly the Internet, cellular phones and a lot of chatting. But some of them might work on the music-machines. Editing and downloading, controlling and tinkering. But mainly they use the Internet and the other options that are there* (Drollvoll).

> *If you consider both sexes separately, you have girls who are very weak and not very keen on computing, and you have girls who are very clever and very quick at picking things up - how to use it. And you have exactly the same on the other side; there are a lot of boys who are really not that very keen on this, who don't particularly want to be in the computer lab, and then you have the speedy ones. And this group is bigger than for the girls. There, you find people who really dive into the matter in depth and who kind of experiment and study the subject, programming and such. There, the majority is made of boys, but the girls are represented. Since we do not really give them a choice, they have to go through some computing lessons. And, I believe that they use this to gain a fairly good level of knowledge, which they use as a basis for their own experimenting. So, lack of choice is our strategy to make sure we involve the girls* (Drollvoll).

Even though the deputy education officer at Drollvoll observes a certain gender divide regarding computer use, he points to a more important intra-gender divide. No matter which divides apply, implementation of computing in the subjects will work as a (gender) inclusion strategy, and thus, Drollvoll has not stated any explicit inclusion strategies.

All the three schools (Domborgen, Dresund and Drollvoll) which I have labelled doubtful or hesitant followers of the ICT and gender policies, have more or less implicit gender focus in their ICT implementation plans, but none of them have an explicit gender inclusion strategy. They question the relevance of focusing on gender as a problem in ICT implementation, and make an effort to include all pupils through gradually implementing ICT as a tool in all subjects.

Further, these schools try to implement computing in areas not necessarily suggested in the White Papers and curriculum, in order to give the school some extra funding and also character. The deputy education officer at Drollvoll even admits that he reads the White Papers to look for phrases and modes of expression he can use in applications for more funding. Thus, the Doubtful followers more or less accept the problematisation from the Ministry, the definitions of the actors and the obligatory passage point. But they question the importance of the problem and are thus lost for the Ministry in the interessement.

The Innovative schools

The last group of schools, given the names Innerland and Innøy, might be regarded as inventive pioneers when it comes to implementation of computing. They offer a basic computer course either in year 8 or in a computer club after hours. What makes them stand out in contrast to the schools in the other two groups is that they manage better to focus on learning through technology, rather than teaching the technology itself. They regard technology as a gateway to learning through interactive use of ICT in the subjects. This also seems to include and trigger more-or-less all pupils like troublemakers, girls normally labelled technophobic, and pupils with learning disabilities or dyslexia. This (gender) inclusion is achieved without a gender inclusion strategy, but through a strategy to include everybody, which means present and future pupils, parents and teachers. This is achieved mainly through working to build a positive identity for all through the home page, networking, and a general inclusion of EVERYONE into the school. And, these schools also use their relative success to gain even more by applying for "reward" funding. But, all fairytales have a sad part, in this one, it is that some of the teachers feel left out and need to be included.

Inclusion of the diamonds-in-the-rough of the future by inclusion of the school

> *ICT plays an important part in our everyday lives. And even though I have to tread carefully with some of our staff, everyone realises that this is a part of what we are doing and that it is very much an issue for the "now", it is not allowed to bad-mouth it. ICT is a part of our everyday lives, but we don't place all of our focus on it* (Innerland).

Due to directives in the White Papers and the national curriculum, Innerland has ICT and basic training for their year 8 pupils on their activity plan. The female ICT pioneers at Innerland offer basic training for both pupils and teachers.

Innerland finds it important to include everyone, especially the older teachers, because some of them are reluctant to use computers. When the eager female ICT pioneers wanted to place the new teacher computer in the staff room, the headmistress feared that this would provoke the more technophobic teachers in their coffee breaks and thus decided to place the computer elsewhere.

> *The entire staff doesn't feel the same pride as I do (about the school's ICT-strategy), not the entire staff. We do not focus on the home page and its content as a topic for discussion because it is a bit of a sensitive issue. The older ranks are the experienced experts of this school. They are very, very, very good at what they're doing in their teaching. And this (ICT) is a world not all of them have entered, and thus we must tread very carefully. If not, we risk upsetting some of them. And we also risk forming cliques in the staff room, so I'm very careful* (Innerland).

The headmistress feels fortunate that the school has several female computer teachers and pioneers, even though some teachers are reluctant and must be treated with care. Innerland has an implicit strategy to include everyone into the school: present and future pupils, parents and teachers, through making them proud of the school and its projects. This is, for instance, attempted through using the home page, which gives the school recognition from other schools, which also might work as a self-confidence booster. Computing, and especially the Internet, is also considered a good form of communication, which invites future and present parents and pupils to communicate electronically with the school. On the other hand, it is important to ask who might be excluded by the use of electronic communication and the stressing of the importance of computers. But again, as is the case with many of the other schools, Innerland finds that most homes do have access to

computers. Further, parents are rarely considered as users of the school in the way Innerland and Innøy do. It is more common to regard parents as outsiders like in Rødvik's more defensive strategy, claiming that the municipality and the politicians make the parents expect too much.

Even though Innerland does not have clear plans for the implementation of computing, they have integrated computing in several subjects through the Comenius project, where they produce an electronic newspaper in English and French for their own pupils and pupils in Italy and France. Further, Innerland is the only Norwegian school participating in the WISE project, which explores online teaching of natural science subjects. Through WISE, Innerland experienced that weaker pupils with low ambitions and little interest in school subjects were inspired and thus "returned" to focus on school.

> *In WISE, we have experienced that pupils who didn't particularly like school and never did their homework, were first in and last out of the classroom, and they were really enjoying it. We have a class, which is quite a challenge, and they've been more or less sensational in the computer lab during the WISE project. They found it very interesting and fun. In this class, 2-3 girls have been among those we've really been watching to keep on track, and they've really been at the forefront all the time! It has been very visible and enjoyable* (Innerland).

Computing implemented in subjects can thus work as de facto inclusion of weaker pupils and girls as well. But Innerland does not observe any particular gender differences regarding computing, on the contrary they find that ICT diminishes some of the differences between people's abilities, and thus, they see no need for explicit gender inclusion strategies.

> *I think gender is less important than the other resources the pupil has. From what I've seen of my 550 pupils' use of computers, I really can't say there's a gender bias. Rather, computing seems to erase some differences including in terms of knowledge. We've managed to make our dyslexic pupils, who work with computers all the time, to sort of stand out, to not hide the fact that they are carrying a laptop, and they are really OK with it. And we have dyslexic pupils who achieve very good marks. Handicaps of all sorts; computing helps even things out a bit. I'm aware that differences might emerge, but I'm convinced that the worst we can do is to put up a stop sign and say we have too much to do, that we can't take part in the Information Society. If we did that, I would feel responsible for making 550 kids lag behind the rest of society. I want us to be at the forefront. I find that a secondary school of our*

> *size needs to have a professional attitude to the use of computers. Our pupils should be able to talk about computers in a calm and balanced manner; they need to be confident even if they don't have rich parents and lots of equipment at home; that's to say the least: you wont get a job in the future if you can't relate to computers* (Innerland).

Computing in academic subjects is regarded as an effective inclusion strategy for all and can work to diminish differences between pupils, for instance for those with learning disabilities. This strategy actually seems to work since several of the pupils I have interviewed from this school started by saying that they were dyslexic. When it comes to the established problematic relationship between girls and computing, this does not seem to apply at Innerland.

> *It is probably correct to place a lot of effort on the girls, but I can't say that I see the tendencies KUF (the Ministry of Education) warn about regarding girls and computing in my school. But of course, it is a different matter when you speak about the entire country and not our school. Our deputy education officer and two of our computer teachers are female; right, it is very deliberate. And of course, that probably affects the entire environment at our school. But, it would be a shame if there were something to it, that computers can widen that gap again. But in all my silliness, I believe, and hope, that it is rather the other way around* (Innerland).

The main challenge is rather that the aims of the curriculum and White Papers do not correspond with the school budget, and that teachers are not given enough time and resources for training. Instead of resigning and focusing on the lack of funding, Innerland tries to have a positive attitude to everything, and even believes that ICT can help them accomplish this.

Their home page is considered as their "front cover", and as important in the marketing of the school. It is thus constantly monitored by the headmistress. This home page is also actively used by the headmistress and other teachers at conferences and meetings to give the school a good reputation among other schools, but more importantly, with the municipality and education department of the county and at a national level. Innerland is actively building a strong network around the school.

> *I see that we manage to make a name for ourselves, and that the Education Office (Statens Utdanningskontor) gets a peg to tie something to, and we might, for instance, leap ahead of the queue of schools waiting for project funding. As headmistress I've*

> *discovered that you have to play your cards right and place your self in the right position; the better you are, the more you get. In order to get funding for projects or the like, you must have a clean path and make sure to tread carefully and address the right people. Then you can actually get quite far and get quite a lot of money. Networks and acquaintances in the right places are important. I'm not being silly when I talk about marketing the school through our ICT-strategy, I sincerely intend to go out into the world and introduce Innerland as the best school in the country. I want us to have such a focus, because I believe that we get better from being proud of what we are. It doesn't necessarily have anything to do with computing; if we talk about schools in general, I want to turn the focus to us being a place filled with skills, and we are the place of work for the diamonds of the future, which we will cut and hone and help to become so beautiful that people will want to buy them* (Innerland).

Thus, Innerland is actively translating their own strategies, trying to pose themselves as obligatory passage point, as we will also see is the case with Innøy. In these cases, the Ministry is not the master, but an actor who can provide additional funding if the schools manage their translation well.

Safe surfing to the future on the Wide, Wild Web

Innøy is a small school in a small municipality on the West coast of Norway. Innøy is different from the other schools due to its location, but also in terms of its strategies for computer implementation. My attention was drawn to this school by their prize-winning home page; the Ministry of Education also recently rewarded Innøy for being a pioneer in their county in applying ICT as a tool for teaching and in developing web-based teaching aides. The school seems to be surrounded with a positive atmosphere regarding teaching and learning, which also affects ICT-strategies.

Paradoxically, compared to several of the other schools, lack of funding and the request for flexible teaching systems are the main driving forces in Innøy's ICT-strategy: Textbooks are expensive and aimed at homogenous groups. Developing interactive textbooks on the Internet is actually seen as cheaper. Further, this makes it easier to include potential pupils with different needs, for instant Muslims in a Christian school. Another driving force is the school's desire to appeal to present and future potential teachers by making the school stand out with its innovative ICT-strategy. Additionally, Innøy uses ICT as a tool to involve their pupils and make them active by providing them with a positive identity which they can be proud in, which, in the next rounds,

will make the pupils and their families give something back to the school (for instance less vandalism and more voluntary communal work).

> *We want to be at the forefront with our ICT-projects; that's important for this school: development is speeding up and we want to be on the train. This is a school on the outskirts; by having interesting projects where we are a long way ahead, we manage to keep our qualified staff. And other teachers might be tempted to come here because exciting things happen here. This is more-or-less a revolution, and we want our pupils to profit from it* (Innøy).

By establishing a close tie between the pupils and their home environment, teaching them to understand, know and love their environment, and by providing them with a positive identity, the headmistress thinks the pupils will become reasonable users of the "wide, wild web", as she puts it. Innøy is less concerned with the instrumental and practical teaching of ICT, and more concerned with teaching the pupils in practice how ICT can be used in their everyday life. Thus, providing all pupils with a username and e-mail address is sufficient to make the (female) pupils feel involved and included in the school's ICT-projects. One father of a year 5 girl reported to the headmistress that his daughter had come home full of pride reporting that "We have won best home page!" When the puzzled father asked if she had any doing in that, she proudly responded "Yes, I have an e-mail address!" A story the headmistress takes as an example of how included all (female) pupils feel. It is important for the school that computing is equal for all pupils. They want to include all pupils through securing access to computers for everyone, based on an understanding that if boys and girls are granted equal access they will use it equally much and well.

> *The IT action plans from the government and the curriculum are our authorisation, and we read in these that it is important that computing is made accessible for all pupils; equality is important. I see access to ICT as the same as access to books and libraries: those without access to ICT for their future will be in the same situation as those who didn't have access to books 50 years ago. And of course there is the ideal of the Unity School (Enhetsskolen), that's also important* (Innøy).

Access is the key to even out the digital divide, an attitude in accordance with the main message from the White Papers. But here, access does not necessarily mean one computer per pupil, which is what many other schools and policymakers ask for; access here means access in different settings like lessons, study time and extra-curricular activities, and access after hours by appointment with the headmistress. The pupils can

also check their e-mail in their breaks. Even though Innøy has tried to secure access for everyone, they do observe gender divides.

> *Last year, the after-hours computer club prioritised the girls. So, girls in the higher years are very competent at computing because they learnt a lot of practical computing. We don't see any differences between boys and girls in the highest years; there you can find boys who know nothing and girls who know nothing. Whether they have access at home or not, is the biggest difference* (Innøy).

> *In the lower years, when it comes to technical aspects, the boys are not as cautious as the girls. The boys are not afraid of pushing buttons or using the computers. But, the girls manage just as well after training and when they feel confident* (Innøy).

Prior to the computer club, Innøy observed that the boys were more skilled and experienced computer users, while now the girls are not regarded as lagging behind the boys. Many girls are regarded as interested in computing and see it as fun; the headmistress credits the computer club for making the girls feel safe. Even though Innøy's official ICT-strategy does not focus especially on girls, the student council has decided it is necessary to separate boys and girls in their extra-curricular computing. Since some boys were found to dominate the computer lab, girls or boys have first priority in the lab on different days in order for the girls to manage more on their own.

But as is the case at Innerland, also Innøy is concerned with including the teachers, both present and future. Computing can thus work as a de facto element of exclusion for some teachers, but the headmistress works to include the teachers as well.

> *It means a lot for this school to be awarded a prize for having the best home page; the pupils were extremely proud and the teachers as well. But, there is a danger in all this, because not all teachers identify themselves with this. The webpage was developed by lighthouse people, pioneers. Even though we have tried to combine pupils and teachers as resources in this, I would like to underline that some of the teachers feel alienated, and these are teachers who are very good at their jobs. My goal is to motivate them, make them feel that this is safe, and to offer them some courses after Christmas. One strategy is to make them find out what they feel they need to learn - I don't want the administration to tell them what they need to do. We need to hear what the teachers want to learn, and it is important that this is integrated in what they are supposed to do in their teaching* (Innøy).

Here, agitation from below is seen as necessary in order for the project to be successful. As is the case at Innerland, we see that inclusion strategies work best for the schools that are already included in some way. This gives a lopsided impression of the very important Norwegian goal of the Unity School (Enhetsskolen).

> *At least there's money in this when the municipality signals that this is important. And it is of rather great importance that there is some money. We're not a computing school, but a school concerned with learning. Computing will play a crucial part in the pupils' learning. The most important things we can give our pupils are skills, the ability to choose and to assess. Furthermore, we are concerned with the ability to master things. We observe that many of the pupils with problems are good at computing. Thus, it is important to let them be able to apply their extra-curricular competence in school. We want to use ICT in the development of our pre-emptive efforts. We've also talked about making a computer workshop where they can tinker and repair machines, and we'll probably establish a computer club as a permanent extra-curricular activity. We use ICT as a tool in relation to several issues. If we mange to find the pupils' point of mastery, we will be able to turn the trend around. And in this work, we observe that computing can work as a gateway for the pupils* (Innøy).

As was seen at Dresund, computing is seen as a tool for including everyone, but especially pupils with difficulties. Innøy extends this, and regards computing as panacea for all problems - like heterogeneous groups of pupils, troublemakers, lack of funding and lack of good teachers. This is an innovative strategy compared to the other schools, and it is innovative compared to the message in the White Papers. The curriculum (L97) is the most important guide for Innøy and they have hardly read any of the other plans or White Papers. Innøy stresses that their initiatives and strategies do not come from above, but from the computer pioneers in their school.

> *Things pushed down from above never initiate any dynamic processes. We need to move the focus away from computing towards learning. We are supposed to educate the pupils to enter a society where they are able to function; thus, they need tranquillity and they need computing. No matter if they are into computing or not, there is no way around. Besides, it's stated in our directions. But there is way too much focus on the engineering; first of all we need computing teachers who are good educators in their subjects. Competence in computing can be found anywhere* (Innøy).

Thus, initiatives are seen to have to be agitated from below in order to be successful. Further, there is not necessarily a clear connection between successful inclusion strategies and having an explicit gender inclusion strategy. At Innøy, according to the headmistress, girls feel included in the work with ICT, even though they have no strategies to include girls, and even though their understanding of gender can be seen as quite dichotomous.

Translation completed?

The message from the White Papers is received, to some extent, by the schools. ICT is regarded as crucial by all schools (for the pupils' futures), but in different ways. Most of the schools also admit that gender equality is probably important (for the pupils' futures). But many of them are also critical towards the way that feminism from above is stressing gender equality, which seems to be interpreted as an old-fashioned appendix to public plans, and no longer necessary or important. Thus, the schools do not particularly agree with the problematisation of girls and computing where girls need to be included. We might say that state feminism is perverted due to school autonomy. Further, it is important to note that non-traditional or "disobedient" schools, schools with strategies other than gender inclusion, have managed to include girls. So it is not necessarily a gender focus that is needed in order to secure success in promoting gender equality. It is not state feminism that secures the few translations that display the desired outcome.

It is more interesting to note all the diversity found in the empirical cases than to assess the relative success of state feminism. According to the state feminism model, one should not expect to find this much difference between seven more-or-less similar schools in "homogenous" Norway, which has the Unity School (Enhetsskole) as a political ideal for the safeguarding of equality (Aune & Sørensen 2001). This should be the case, regardless of whether the schools follow the policy instructions from the Ministry or not. But the picture is never that clear and by applying ideas of translation inspired by Callon and Latour, we see that the schools are not disobeying or betraying their Master, they just understand the actors, associations and goals differently from the policymakers, and also, from each other. Thus, policymakers fail to establish the kind of actor network they need in order to establish their goals; they fail in their efforts at problematisation, interessement and in particular of enrolment and mobilisation. They are not able to construct the factish or girl inclusive technology they want to be present in all Norwegian schools.

The Resigned schools deny that there is a problem and are lost for the policy makers in the problematisation. The Doubtful followers and the Innovative schools "accept" the problematisation, but especially the Doubtful followers do not find it important enough. Thus, the Doubtful followers are lost for the policy makers in the interessement. The Innovative schools are enrolled in the problematisation and interessement. But they want to follow their own strategies; they want to be the obligatory passage point themselves. Thus, none of the schools pass successfully through the process – they are not successfully translated.

The translation model has been developed to describe how scientific laboratories influence each other and the outside world. In the original formulation of Callon and Latour, translation is based on a combination of scientific authority and rhetorical ability, including the capability to achieve results that are perceived to be common aims. In principle, there is no reason why political institutions could not achieve the same kind of actor networks.

Arguably, what has happened in this case is that policymakers have been too certain about their bureaucratic authority vis-à-vis the schools, thus neglecting the need to make sure that problematisation and interessement with regard to girls and computers were sufficiently developed. Above all, it is clear from the statements of the school administrators that the policy instruments that are applied are insufficient to enrol and mobilise the schools. In short, the policymakers' rhetoric is too weak.

This leaves the entities that are supposed to be included in the visions of inclusion strategies for girls, with considerable autonomy. They become quite independent actors, who shape their own ICT strategies as they see fit. Instead of the policymakers performing the translation of their gender and ICT policy to construct an actor network that includes the schools, the school administrators have the freedom to do their own translation to create local actor networks within the individual schools (or not). It is this freedom, provided through the weak rhetoric of policymakers that permits the development of the diversity found between and within the schools. In fact, we observe that the school administrators act as designers of the technology of "girls and computing in school" in a rather peculiar manner. Instead of utilising the "design criteria" offered by policymakers, they construct their own. This construction is largely based on their own point of view and their own experience, similar to the so-called I-methodology frequently used by design engineers whose point of departure is their own needs and interests.

The "obligatory passage point", suggested by the policymakers, was to find the answer to how we can make more girls use computers. Some schools agree that this is probably an important passage point, but many silently disagree because of what they consider to be competing and more important issues. Further, some schools silently disagree, but nevertheless seem to reach the goal through other strategies, like including all pupils. Thus, there are no explicit alliances formed between the identified actors.

The stable identities offered for the actors are also subject to negotiation; most of the schools seem to agree on the characteristic of policymakers as too theoretical and distant from the everyday life of schools. The schools accept their roles as educators of tomorrow's work force, but they choose different strategies to accomplish this, ranging from simply "you have to take what we have" to "turning the pupils into partners through taking responsibility for their wider identity".

Computing itself is less visible in the processes, many schools accept its stable categorisation as "something the girls have to learn", and add that it is something "we cannot afford to give them" or "we do not have enough knowledge to be able to give it to them". The Innovative schools are mainly regarded as innovative because they refuse this stable categorisation of computing and rather negotiate its identity with other allies. This suggests a gross weakness in the policymakers' identification of the computers, which is often aligned with the notion of a unified technology with inevitable and self-explanatory importance for all, while the users see computers from many different angles. When it comes to the identity of the girls, many schools agree with the stable, dichotomised gender identities offered for the pupils, but explain the cause and remedy differently, as well as the importance of these differences. But, this stable gender category is so well-known that the schools that do not see it for themselves, still accept it.

Since the act of interessement is not successful in establishing an alliance between actors, due to doubts about the problematisation of the topic of girls and computers and lack of consensus about stabilised identities of the actors, the enrolment is not successful either. And, the actors simply refuse to be mobilised by the policymakers. In the end, there are so many different and competing local constructions of the passage point "girls and computing" that no one can gather around a common collective construction of the gender and ICT problem. The schools carry out their different local translations, they know and understand the message in the White Papers, but still reconstruct it and adjust it to their local environment because, to put it very simply, they

feel they have no choice, because they partly disagree with the message, or because they feel they know better.

Despite our constant observations of heterogeneous gendered practices in everyday life and many social scientists' stressing of unstable and changing gender categories, we still tend to organise our understanding of the world around seemingly stable gender dichotomies; this is also the case with the translations we have seen in this article.

It is interesting and important to note the stable and dichotomised gender constructions in the relative success stories of the Innovative schools. Gender inclusion strategies are not always necessary for gender inclusion, and dichotomised gender categories do not necessarily hinder the successful inclusion of diverse gender categories. Paradoxically, there is a clear danger of gender-focussed strategies being gender-stereotypical and that lack of gender focus is also due to and causes gender stereotypes; which the different stories of the schools show.

This leads to important questions regarding what should be assessed as successful inclusion and how we can measure such a success. Should successful inclusion be measured by the amount of girls and the amount of hours spent in front of the computers, by the amount of any computer use or just that of useful computer applications, or should it be measured by how well the girls feel they master the technology and to what extent they perceive themselves as "real" computer users? Further, is a sense of feeling included essential for actually making use of the computer, and is there necessarily a clear-cut relation between feeling included and actually making use of the computer?

Additionally, it is important to ask whether we need specific efforts to include girls. Are gender inclusion efforts only positive? Do gender inclusion measures lead to inclusion in another technology by establishing a girls' room opposing a boys' room? And will this contribute to strengthen the continuously stable hierarchisation of the gender category where the co-construction of gender and computing continuously rank the masculine use and competence above the feminine?

Following the translation model we might say that society is performed through everyone's efforts to define it. Several of the actors (implicitly) agree that girls are different from boys, and in this case, especially when it comes to computing. Thus, the problematic relation between girls and computing, the homogenous girls' deficit in using computers, is defined and accepted as a problem in society by a sufficient number of actors, because it fits so well with many of the other definitions of deviating and subordinate feminine traits. The experience of the Innovative schools suggests that gender inclusion efforts are not necessary. Even though the Innovative schools succeeded in including

girls without aiming specifically at the girls, they too mainly accepted the stable gender category, and by silently accepting it, they unconsciously and maybe unwillingly contribute to passing it on to other actors.

If the implementation model was correct, a powerful actor, for instance materialised through the state feminism, could just demand a stop to these unconscious transportations of the gender hierarchy. State feminism, through the policymakers in the Ministry of Education, has tried to place parts of this order through the passage point of making more girls use computers. Cathrine Holst (2002) criticises the Norwegian state feminist social democracy for narrowing the feminist discussions to revolve around gender differences and representations of two homogenous groups. State feminism as top-down feminism might thus be labelled "difference feminism", which argues for the recognition of women's experiences and values. This is contrasted to an equality feminism, which argues that women should be granted the same rights as men. My allegation is that the state feminism regarding girls and computing is based on an unfortunate mix of difference and equality feminism saying that girls are different from boys, but must be granted the same ICT options as boys, or rather, must become just like the boys (Gansmo 2002a and 2002b). Thus, state feminism might actually work as a masculinisation project.

But according to the Resigned, Doubtful and Innovative schools, the policy makers have not succeeded in making the schools accept their instructions. Based on my data, I cannot assess whether the implementation attempt by the policymakers actually has contributed to making the situation worse when it comes to gender equality, but I can suggest that they have succeeded in contributing to the implementation of the notion of the dichotomised gender. What I also suggest is that the "disobedient" schools, through their alternative translations of the order, manage to bring a little chaos into the seemingly forever-stabilised categories. And thus, maybe more disobedient translators are needed?

Notes

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[1] St.meld. nr. 39 1983-84 *Datateknologi i skolen,* Kirke- og undervisningsdepartementet, Oslo.

[2] St. meld. nr. 24 1993-94 *Om informasjonsteknologi i utdanningen,* Kirke-, utdannings- og forskningsdepartementet, Oslo.

[3] *IT i norsk utdanning. Plan for 1996-99*, Kirke-, utdannings- og forskningsdepartementet, Oslo.

[4] *IKT i norsk utdanning. Plan for 2000-2003*, Kirke-, utdannings- og forskningsdepartementet, Oslo.

see Gansmo 2002a for a more thorough description of these policies.

[5] See Gansmo 2002b for a discussion of how the girls have been displaced into the White Papers by the policy makers.

[6] I have not analysed whether the informant's gender is relevant in this translation model. Still, it is interesting to note the gender distribution among the administrators, even though the population is very small: The Resigned are female, the Doubtful followers are male, and the Innovative administrators are female.

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THE GENDER GAME. A STUDY OF NORWEGIAN COMPUTER GAME DESIGNERS

Helen Jøsok Gansmo, Hege Nordli and Knut H. Sørensen

The role of computer games

Computer games have received much attention in mass media, not the least because they have conquered a substantial space in the everyday life of children. This has led to much anxiety related to the consequences of such game playing, for example in terms of a negative impact on children's social life and potentially harmful consequences of violent games. On the other hand, it is also commonly believed that to play computer games may be a gateway to become a skilled and enthusiastic user of computers. Moreover, many newspapers provide reviews of computer games in line with reviews of new books, new CDs, etc. At the same time, however, the frequent invocation of metaphors like "boy's room competence" in the public discourse about computers also indicates how this gateway has a definite masculine bias (see Gansmo et al. 2003). In fact, it has often been argued that computer games are designed by men for men (boys), and this masculine prerogative of game design has been held as a mechanism that is a hindrance for girls and women to get included into the use of computers and other information and communication technology (ICT). When computer game playing is considered mainly an activity for boys, this produces concerns that girls are missing out on this opportunity to become introduced to computer technologies, or metaphorically, shut out of the boy's room. This may be reinforced by the nerd-like image of intensive playing of computer games (see, e.g., Lie 2003, Cassell and Jenkins 1998b).

However, these assumptions have not been well substantiated, and the situation with regard to gender and computer games appear to be quite paradoxical. True, the great majority of computer games appear to be modelled upon tales and fantasies usually considered masculine. On the other hand, recent US surveys suggest that the number of women game players are much higher than assumed and at the same level as boys and men.[1] A new Norwegian study of young teenagers shows that girls are quite interested in playing computer games, even if boys may spend more time doing so, and also more time talking about their game playing activities (Gansmo 2003). This contrasts to previous research,

[1] http://www.wired.com/news/games/0,2101,60204,00.htm (downloaded 2003-11-02)

which showed that girls generally claimed to find computer games rather uninteresting (see, e.g. Gansmo 1998, Håpnes and Rasmussen 1997). While it is possible that girls in previous studies consistently have underreported their interest in computer games (Gansmo 1998, Stuedahl 1999), it may also be that girls' relationship to such gameplaying has changed (see also Kerr 2003).

Thus, it is important and interesting to study the design of computer games to analyse empirically to what extent and how gendered assumptions work as design criteria, and whether the computer game industry now is making efforts to provide products that may be attractive also to girls and women. In this paper, we hope to contribute to an improved understanding of the dynamics of gender in computer game design, with an emphasis on what the industry considers appropriate strategies towards including women as gamers and the way gender is drawn upon as a design resource. Thus, we will look into how computer game designers understand gender as well as computer games, and how they perceive the relationship between the two. Is it true that this is a boy's industry in the sense that it by default constructs computer games in a masculine image? Or have computer game designers discovered the importance of girls and women as a market, trying to cater for their interests as well?

The co-construction of gender and computer games

About 90 per cent of Norwegian boys and girls have access to computers at home (Sølvberg 2002). According to the 2001 media survey in Norway, 31 per cent of those who used at PC at home on an average day used it for games or other entertainment. The percentage was higher for men than for women, 35 per cent compared to 21 percent. Among children, the number is much higher (Vaage 2002). 77 per cent of children aged nine to 15 state that they play computer games or play with the computer in other ways on an ordinary day.[2] As expected, the frequency of game playing is higher among boys than girls. On any given day, 59 per cent of boys aged 9 to 15 use a PC or a TV game machine for game playing. Among girls in the same age group, the percentage is 38 (Vaage 2002). Thus, this survey confirms the expectation of boys playing computer games more frequently than girls. On the other hand, a substantial part of Norwegian girls are also playing. Computer games are definitely not for boys only. However, we have no statistical data about what kind of games boys and girls are playing.

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2 http://www.ssb.no/emner/02/barn_og_unge/2002/fritid/main.html. (downloaded 2002-12-16).

Research about computer games is surprisingly limited, given the substantial public interest in the issue (Buckingham 2002). A common theme in several contributions is the worry that game playing somehow may be harmful to children and adolescents. First, it is frequently noted that many computer and video games are quite violent, and several studies claim that the playing of such games raises the level of aggression (Dill and Dill 1998, Williams and Clippinger 2002). However, it is also suggested that for most children, game playing is a fairly absorbing and harmless activity, maybe even beneficial since it may allow the players to "blow off steam" (Griffiths 1997, Allison 2001). From a historical perspective, it may also be argued that the worry about computer games fits into a pattern of moral panic arising with most new media technologies (Wartella and Jennings 2000). However, there is no doubt that the computer game industry has grown into a major economic undertaking, with great importance to the global information technology economy (Kerr 1999).

Second, there have been concerns that the playing of computer and video games are harmful to the development of children's social competence, since game playing is considered a solitary activity. However, it seems to be a consistent finding that to play such games often incurs interaction with other children, and game playing may be a key to social recognition among peers (Facer et al. 2001, Jessen 2001, Orleans and Laney 2000, Vestby 1998).

Third and most pertinent to our analysis is the potential role games may play in gender socialisation, and the gendered character of computer games. It is a consistent finding in all studies that girls have less access to computer games and play less often than boys (Buckingham 2002). Cassel and Jenkins (1998a) argue that this puts girls at a disadvantage because they are excluded from the computer experience that game playing may offer. Therefore, they criticise the computer game industry for neglecting girls' interests in its single-minded pursuit of games that fit into a boys' culture. The topics of the games and the stories on which they are based tend to be very much embedded in masculine storytelling practices, with its emphasis on violent adventures, competition and shooting. In short, it is argued that the majority of computer games have a content that turns most girls off.

Cassell and Jenkins (1998b) give an account of efforts to remedy this situation through a "girls' games movement" that has aimed to provide girls with games that fit their needs and interests better. The iconic case is Mattel's game "Barbie Fashion Designers", which has sold in large quantities. This also illustrates a dilemma related to this effort. On the one hand, such games tend to reinforce quite traditional gendered

images and a dichotomous conception of gender. Boys want to shoot and kill, girls want to dress up and to have romance. On the other hand, several of the proponents of the "girls' games movement" want to empower girls by creating and sustaining a space for girls' engagement with computers, because familiarity with computer games may encourage girls and provide them with more confidence towards becoming more "serious" computer users (Livingstone and Bovill 1999).

However, as noted in the introduction, girls do play computer games and not just games tailored to what traditionally is perceived as feminine tastes. Thus, the situation is more complex than just seeing computer games as "boys' toys". We know that women computer enthusiasts engage in computer game playing (Gansmo 1998, 2003, Nordli 2001, 2003), but a recent US survey makes even stronger claims. They found that the majority of those buying computer games are women, and that women constitute more than half of those engaged in the playing of online computer games.[3] Kerr (2003) argues that while women may find many computer games tailored too much towards boys' or men's tastes, they are highly critical towards games made particularly for women. Still, Cassell and Jenkins seem to be correct in their assessment that too few computer games are designed explicitly to cater for what normally would be considered feminine tastes. This raises the issue of what design criteria that should be mobilised in order to include more women users of computer games. It should be noted that this does not necessarily imply the establishment of a simple gender dichotomy of such criteria. Rather, this point should be seen as an invitation to be more reflexive about the assumptions underlying the games' design philosophy.

A study of a Norwegian effort to provide girls with a CD-ROM that was made to make them more interested in using the Internet identified three design criteria, which should be understood as a contrast to a masculine/boyish preference for noise, fun and complexity (Spilker and Sørensen 2001):

- quietness
- knowledge
- convenience.

More specifically related to computer games, some research suggest that girls prefer different sorts of narratives than boys do, a parallel to differences between books written for girls and for boys. This would imply that girls prefer non-aggressive play activities that allow them to

[3] See note 1.

create fantasies set in recognisable settings with familiar characters. It has also been found that girls prefer a mode of play where they control the timing as well as the direction of the game, and games that allow them to play in an exploratory, open-ended fashion, so that they can have control of their environment (Subrahmanyam and Greenfield 1998).

We do not expect computer game companies to have altruistic motives with respect to women. Rather, we would expect the issue of inclusion of women to be primarily about selling. If they are at all interested in the issue, we would anticipate that their interest in this is fuelled by economic motives. More women users mean a larger total of customers, which in turn would produce a larger sales volume.

Nevertheless, it is not obvious that such companies will develop inclusion strategies towards girls and women. Thus, it is interesting to study if they do and how they reason around the issue. By inclusion strategies we mean conscious activities or sets of activities aimed to (1) recruit people into and (2) retain and socialise them within some system. To analyse such strategies involves the analysis of the following aspects (Sørensen 2002):

- The underlying understanding or model of the inclusion problem, with particular emphasis on the gender-ICT relationship, and its implication for men and women as participants in user and designer constituencies with a focus on computer games.
- Their assumptions about critical activities or actions needed in order to achieve inclusion, and the capacity of the activities to induce change.
- How these activities and actions are initiated.

The inclusion concept as it is described here works from the idea that gender and technology, in this case computer games, are co-constructed or mutually shaped. This perspective has been developed through feminist studies of technology (see, e.g., Berg and Aune 1994, Cockburn and Ormrod 1993, Cockburn and Fürst-Dilic 1994). The main argument is the observation that in the making of a particular socio-technical artefact, the perceptions of the gender of the users as well as the qualities of the artefact are produced simultaneously or in interaction.

The notion of co-construction of gender and ICT also draws upon constructivist approaches in technology studies, emphasising the way technologies and culture are produced simultaneously. This happens because technology and culture are seen as emergent, interactive phenomena, where the development of the one draws upon and facilitates changes in the other (see, e.g., Latour 1987, Pinch and Bijker 1987). When applied to gender and computer games, it becomes clear

that we need to examine categories like male and female as well as computer games and game playing as dynamic forces, rather than in a dichotomous and transhistorical way (Faulkner 2000). Even if male and female qualities are generally not perceived as of equal importance, the study of the consequences of this inequality should be informed by the idea that gender and technology are co-constructed, and in a an unpredictable way. The one is made by making the other, and vice versa, and the outcome has to be studied through empirical examination of actual cases (Berg 1996, Lie and Sørensen 1996).

Consequently, in this article, we will investigate how Norwegian computer game design companies approach the issue of inclusion of girls and women, and how this affects their ways of designing games, with particular emphasis on how they co-construct gender and games. This also implies theoretical engagement with ideas related to the social shaping of technology, particularly with respect to the processes through which gendered tastes and values are transformed (or not) into computer games.

Method

The paper is based on interviews in four computer game companies in Norway:

- Funcom (www.funcom.no) is a world leading online entertainment developer and publisher. Funcom was established in 1993 and they have about 130 employees in Europe and the US. They have 19 titles and have sold more than 3 million units. Some of the games they have produced are: *Casper the friendly ghost, Dinosaur's tale, Dragon Heart, Pocahontas, The longest journey*, and *Anarchy Online*. Their target group is "boys" between 18 and 25. Here, we interviewed a project director, Fredrik.
- Innerloop (www.innerloop.no) was founded in 1996 and employs approximately 20 people in Norway. Their game production includes: *Flight simulations JSF (joint strike fighter), Extreme Sports, Project IGI,* and two ongoing secret projects. Their target group is "boys", or rather established players/established purchasers of games. Here, we interviewed the managing director, Ivar.
- Caprino Video Games (www.caprino.no) was founded about 2000 in order to turn the famous film *Flåklypa (Pinchliffe) Grand Prix* into a game. They will continue to develop other games based on the famous films of Norwegian filmmaker Ivo Caprino. Their aim is to produce high quality, non-violent games appealing to a broad group of gamers, covering several generations. Their target group is

families, or "everyone between the age of 4 and 104". Here, we interviewed a producer (Christine).

- Artplant (www.artplant.no) was founded in 2001 by four experienced game producers from Funcom and Innerloop. Their only game released as the company Artplant is *Blåfjell*, a children's game based on a TV-series for the Norwegian Broadcasting Company. Their target groups include casual gamers, families, girls and potentially housewives "because they are different". Here, we had a group interview with four men, one programmer and three designers (Arne, Arvid, Are and Artur).

In total, we have interviewed seven persons, six men and one woman. At Artplant, we interviewed all four employees. In the three other companies, we talked to representatives of the management. Thus, our interviews have been focussed on strategic aspects of game design, rather than the hands-on experiences of doing design and the reflections emerging from this. However, we believe the strategic thinking to be the most important since we have to assume that this directs what the companies do. We cannot claim that the informants are representative of their respective companies, except for Artplant. However, we found the information given to us to be in line with the impression we have of the companies by looking at and playing some of their games.

In the interviews, each of which lasted about one hour, we talked about how they developed their ideas to a published game, who is the typical gamer in their visions of their market and in general, different segments of gamers, how they market their games, their ideas about girls as gamers, and whether it is important to make more girls interested in computer games.

Doing computer game design in Norway: A gendered focus?

Funcom

The Norwegian computer game history can be said to have started in 1993 when five young men thought it would be cool to make games and decided to start Funcom Productions. They soon managed to get an important contract with Disney, and sat out to make a game for them. In 1994, Funcom increased its size to 76 employees. At the end of 1995, the total number of employees in Oslo was 110, and Funcom kept growing in the following years, nationally as well as internationally.

In 1996, the company had become too large to keep going in the same way as before. They changed their strategy from primarily growth and learning, to what they call a more professional phase with better

systems and better care of its future margins. It was also at this point that Funcom recognised the immense potential for online gaming. They were in the lead of initiating new and at this point groundbreaking projects. Funcom launched its first online product in May 1997. This was a multi-player Backgammon. It was later followed by *Chat Café*, *Matchmaking for Backgammon*, and *Paradigm Shift*, a six-player strategy game. As part of the company's strategy to maintain creative control and increase margins, Funcom was looking to expand its operations into electronic publishing.

Anarchy Online, the largest project Funcom has ever undertaken, was finally released in Scandinavia and the USA in June 2001. It had taken Funcom six years and a lot of money to make it. After what they characterise as a rocky launch, things started to stabilise during the autumn. By September, the game had improved enough to win the "Best Multiplayer Game of Show" at ECTS, Europe's premier trade event for the interactive entertainment industry.

Today, Funcom wants to specialise on online games since they regard this as the future. The idea is that customers buy the game in the store when it is launched. The price is about NOK 3–400, approximately € 50. With this unit, they may log on to the multiplayer environment. The first month is free of charge (however, you do of course have to pay for your Internet connection). After the first month, the player needs to pay a monthly fee to be able to keep on playing. With this subscription model, Funcom believes they will be able to make more money in the long run.

Anarchy Online is an action game with elements from science fiction. According to our informant, this means that the game would most of all appeal to a masculine audience. However, as the development work went on, the social element of the game came more and more into focus:

> *Online games motivate women more than usual games due to the social factor, we presume. Anarchy Online is based on an idea about action in science fiction, that is, more or less targeted towards a masculine audience. What became visible in the process, and which we developed, was the social aspect, which is very important in the role-playing games. Further, we depend on support from the community around the product. Actually, we have a whole department busy keeping in touch with our fans. And we see that communities are more and more important. It makes the presentation more human, more soft, because we want a more emotional attachment to the*

> *product. And besides, we get the world's best feedback from our customers* (Fredrik).

Fredrik believes that role-playing is a female segment, and that the social focus of such games made them more attractive to women gamers. They also like access to candlelight and flowers that they can give to their lovers in the game. However, many men also find role-playing appealing. Thus, some attributes considered interesting to women, are seen as interesting for gamers in general, even if women gamers are perceived to be different from men.

From Fredrik's comments, *Anarchy Online* appears as an effort to satisfy different gamers. Some want action and role-play, some want exploration and role-play, while others again are more into exploration and action. In *Anarchy Online*, Funcom claims that you can get it all. They do not have any statistics about the gender distribution of their players, but they claim they have many female characters signed up. However, they cannot know whether these female characters are representing men or women players. It is well known that many men enjoy using a female character in such games. So, even though there is a large amount of females in the "room", it might not be that many women players. On the other hand, it is supposedly also a quite widespread practice among women players to choose characters that are "gender neutral", like some kind of animal, or to pick a male character.

However, Funcom believes that their main audience is men. Fredrik even claims that many of the women that take part are there because they have a boyfriend or a husband who plays, and that they want to be there in order to do something together. The game is thus only of secondary interest to women, because they are more engaged with social relations. Thus, they consider women to be a kind of hang-arounds, rather than "real" players.

Funcom rely on feedback from their users, and claim it is hard to find good ways of testing games. They test that everything works technically as it is supposed to. The graphics, the animations and the coding need to be of the highest quality, our informant states. They also test the games to make sure that they work well on different operating systems. Most of all they feel that they themselves know what players want and desire. All developers have played many games, and they test them by seeing how they themselves like the different aspects of the game.

90 per cent of the employees in Funcom are men. The women work mainly within the administration. They have one woman coder, and they used to have one woman graphics designer. Fredrik claims that the game developers work there because they want to have fun. You have to be an

enthusiast to make computer games. You do not earn a lot of money, and you work long hours, so it is not as fashionable as many people tend to think.

Much of their design ideas are based on the so-called I-methodology. This concept highlights the fact that introspection, the designer's own experiences and tastes, underlies his (or her) input. Since almost 100 per cent of the designers are men, women are not an obvious source of information about interests and preferences. Moreover, Funcom does not have a strategy to include more women or girls as players. Of course, they want to sell games, and they make games they believe will sell and provide profits. However, Fredrik said that by making games just for women, Funcom could easily trap them into a stereotypical pattern of behaviour:

> *If we were given money and opportunity to make a game for girls without thinking about the market potential, I think it is important to beware not to lock women in an image of social activities. Some of the most violent gamers in Anarchy Online are girls. And they are happy to shoot more than the other players. They are aggressive in a way we normally think men are. So, it is important to beware of such stereotyping. Research on women, or, now I speak from experience with my wife. She would like to play, but do not have the time to sit down for long periods, she doesn't have time to relax, because she feels she has to be useful. But, several of the games require that you sit for hours, maybe the entire weekend. That's what we call the quick-fix factor. You cannot achieve anything in 20 minutes. You have to invest more than that. Because it's social! You can't have a quick-fix factor with your friends either. You have to invest hours, dinners, and films in their company in order to have a friendship. It's the same with games. But, for some reason men are raised to play* (Fredrik).

Thus, the "quality" of the game and good graphic user interface are the most important aspects of the game. *Anarchy Online* and many other games of high quality would therefore be something women also could take part in and enjoy. The problem, according to our informant, was rather that women in general do not see game playing as a suitable thing to do. There is always other, more important things to do, and women do not know how to relax. He told us that therefore, we should pay attention to our kids and teach the girls how to relax and have fun. Then they also would enjoy playing games as they grow up.

Innerloop

Innerloop was founded in 1996. Today, it employs approximately 20 people in Norway, so it is not a large company, but still the second largest of the computer game design companies in Norway. The first game released from Innerloop was the award-winning flight-simulation *JSF - Joint Strike Fighter* from December 1997. In December 2000, they released a sports-title called *Extreme Sports* and the 3d-action game *Project IGI*. Normally, they only engage in one game at a time, and everybody work together on this specific product. The employees are in their late twenties, and they are all men. Most of them have a professional background equivalent to programmers. Earlier, most of them spent a lot of time playing games, but today the culture has changed, mainly because the employees are older and most of them have families now, according to Ivar. Therefore, they cannot work and play around the clock as they did before they got family commitments.

Ivar, the manager of Innerloop who we interviewed, said that they do not decide on their own what games to design. They need to make games that publishers want. Thus, decisions are made together with publishers. They have to adjust to the market and cannot just follow their own desires. However, they may choose which publishers to work with. Thus, choosing a concept for designing a game is most of all a process of negotiations. Innerloop has an idea, they get in touch with a publisher, and then they negotiate about the elements of the game and what to expect from it. This process goes on all through the design process. Thus, publishers are active participants in the development work.

Innerloop has made a variety of games. Ivar said that they do not think much about who the player is or will be. When they make games, they are most of all concerned with the quality, as he puts it:

> *We don't actually think so much about the players or the users we are designing the game for. We think more about quality. Of course, in relation to design and such we also consider the quality. That people should find the game cool. But that usually corresponds with what we find cool. We have a very broad frame of reference. We have played whatever there is to play* (Ivar).

Innerloop assumes that other people will like the same elements as they do, so they just make games that they themselves enjoy. The employees are advanced gamers and have played more or less all types of games for many years. That makes them good at judging what will sell. As part of the development process, they also spend time comparing their own game to other games that they know have been recognised as good.

Innerloop tests the game themselves, and Ivar felt pretty sure that they would know if a game is good or not. In the end, they also do focus tests with typical gamers and ask them to give feedbacks. At this point, the typical gamer is a grownup man.

Innerloop has never tested any games on girls. This because they claim that women are not a potential market to them. It is safer, Ivar says, to go for already established markets. Boys and girls have different interests, and boys are more disposed to spend much time in front of a computer. Boys are not as interested in human relationships as girls are. Boys are also provided with more status by being good at playing computer games. Among girls, though, it could rather work in the opposite direction, according to Ivar.

Caprino

Caprino was founded in 2000 in order to turn a very popular Norwegian animated film, *Flåklypa (Pinchliffe) Grand Prix*, into a game. The film, produced by Ivo Caprino, was launched in 1975 and has since then been seen by 5,5 million people, which is more than the actual population of Norway today. The film has also been dubbed and translated into 12 other languages. To celebrate the film's 25th anniversary, a new version with digital sound was made, which ran at all major cinemas in Norway in 2000.

The computer game *Flåklypa* has so far sold more than 160 000 copies, which is a record in Norway. Computer games that sell more than 30 000 copies are exceptional. There is an English version of the game, *Pinchcliff*. *Flåklypa* has also been translated into Danish and Swedish and was launched there in 2002, but so far, it has not been as successful as in Norway. The game's reviews have been even better than in Norway, but they struggle to get into the shops. It is difficult to be an independent game company like Caprino. They need to go through a distributor, and it takes great efforts to get an agreement.

It took a lot of money to make *Flåklypa* into a game. Most of the funding came from public sources through a fund for media development and The Norwegian Industrial and Regional Development Fund (SND). In addition, there were some private investors. Caprino has planned to start making a new game based on another one of Ivo Caprino's films, namely *Askeladden*, but they do not yet have the funding in place. According to Christine, there is no way they could raise the amount of money it takes to make another game themselves.

The total cost of making *Flåklypa* came to NOK 18 million (around € 2,3 million). It took almost four years to develop, and about 20 people worked full time during those years. Today, Caprino employs about five

people. The developers behind *Flåklypa* have mainly been men. However, the head of the company, who came up with the idea of transforming the film into a game, is a woman, and a couple of women have been very active in the design of the game. This has been a strategic decision in view of the diverse players they wanted to reach:

> *Normal games demand some experience as a player. The threshold is rather high. We've worked a lot on that with Flåklypa, in order to make it simple for everyone. We've put a lot of effort in the help function in order to make it simple and complete. And part of the reason for that is my lack of experience with games. I started with the questions I as an inexperienced game playing mother would have in order to get my child started on the game. So, it has definitely been an advantage to be an inexperienced woman when making the help function. I have made it available for basically everybody. The games are normally based on a gender logic. And further, boys usually go right ahead and start the game, while girls start with reading the manual* (Christine).

Further, the women employees have also been considered important for the atmosphere of the company. When the work was in its most intense phase, the group of young men workers more or less lived in the office. According to Christine, they worked long hours, ordered pizza, drank coca cola and played computer games until the morning. They slept in sleeping bags on the sofa in a corner of the office. This culture has changed in the later years as these boys now have girlfriends and families and tend to spend less time at the office.

With the game *Flåklypa*, Caprino says they want to reach out to players in the age group between 4 and 104. According to Christine, they have initiated a new segment of computer games:

> *We had in mind that we wanted to cover the family segment. Family, quality and non-violence, in order to compensate for much of the existing games. We cover the entire family segment, which really is a new segment this game has created. We have 3-4 year-olds who play the easiest games, they pick flowers and things like that. Somewhat more experienced 10-15 year-olds play car games and try to assemble the car parts, and constantly try to improve their score. And then, we have the adults, who look forward to putting the kids to bed so that they can play alone afterwards* (Christine).

The game is constructed so that there are simple parts that 3 – 4 year-olds can do, while more advanced players can find pieces that are more

challenging. The game is said to grow with you as you get older or more skilled. And the basic or easiest tasks in the game are described as typically feminine, such as picking flowers. *Flåklypa* is a PC game, and the intention was to make it as easily accessible as possible, meaning that also very inexperienced users should be able to play.

Flåklypa is supposed to be a game for the whole family. This has always been Caprino's basic idea. It is about quality and non-violence. Quality in Caprino's terms is arguably more associated with family values than the high tech quality Funcom and Innerloop speak about. It has been important for Caprino to make a game without any kind of violence, as a contrast to most other computer games. The game, as the film, has nearly only male characters. However, the developers claimed that the main characters (all male) are someone with which everybody may identify. The only female character, Soline, is hardly visible in the film, but she has been made a bit more visible in the game because the women developers thought it was important.

Flåklypa contains many small games with different levels of difficulty. In the main game, you must collect different items that in the end are needed in order to build the car for the car race, the Grand Prix. In addition, there are several smaller games. There is a balloon game, a workshop where you can fix bikes, a labyrinth/pacman-like game of picking flowers, and there is a Tetris-like game where you need to put together the different parts needed to transport oil from one place to another. Some of these small games are designed in order to cater for girls' as well as everybody's interests. The developers also wanted it to be a game where players could learn something. Players may learn by using the built-in "factopedia", where they have written about things like cultural history.

Flåklypa was a success from the very start. It was launched just before Christmas 2000 and they received so much coverage through the media that they hardly had to do any marketing. The film is well known; especially among the generation that today has small kids or grandchildren. Our informant claimed that the response had been positive from a varied age group, and as far as she knew, girls enjoy the game as much as boys do. They have even heard of families that have bought a PC just because they wanted to play this game.

> *One of the biggest challenges with the family segment is that we have to make the game adjustable to computer equipment which may range from 2 years old to the newest and hottest equipment. That's one of the challenges, and probably one of the reasons why so few dare make a go at it. If you have a family with only daughters, they are probably not engaged in*

> *upgrading their equipment as much and as often as families with sons who are between eight and 10. These boys demand more in order to be able to play the newest games* (Christine).

Artplant

Artplant was founded in 2001 by four men who for many years had worked for Funcom and Innerloop, Arne, Arvid, Are and Artur. They are all experienced computer game designers and have worked in this industry since they were 17–18 years old. They are now in their late twenties and characterise themselves as hard-core gamers. One of them works as a programmer, while the other three are designers. The only game produced by them as the company Artplant is *Blåfjell*, a children's game based on a tv-series for the Norwegian Broadcasting Company. They started working with *Blåfjell* as employed by Innerloop, but left Innerloop to start by themselves in the middle of the process. So far *Blåfjell* has sold 30 000 copies, which is not at all as well as *Flåklypa*, but nevertheless successful in a Norwegian context. At the time of the interview, they were making the game to go with the 2002 Christmas series on public television, *Jul på Månetoppen*. They are also engaged in making a game for horse-interested girls.

While employed at Funcom and Innerloop, the four men felt that they worked to reach hard-core gamers. Their reason for leaving and starting Artplant was that they were tired of all the gigantic projects and of competing with the top of the world. Instead, they wanted to make games that were not as universal (less comprehensive), but which at the same time should have the same high quality as they used to make. They wanted to make smaller quality games that did not need 40 people and three years to be developed, but something that could be done by four men in four months. Thus, they had to search for a different market segment. So far, they have worked towards children's television series and a magazine for youngsters (girls) with an interest in horses. In these segments, you find players who do not necessarily play a lot, but play every now and then.

According to our informants, Artplant always does a bit of focus testing. However, they say it is not enough and that they would have liked to do more of it. Since they are making games for players that are different from themselves, they need information about what this group likes and enjoys in games. They also rely on information from their friends and families, like younger sisters, on what they perceive to be the interests of different groups.

The men at Artplant claimed that the best strategy was to make games based on already existing interests among the group you want to

reach. When they make the game for the horse club magazine, they have been told to make a game for girls aged eleven and a half, who feel like 14. However, they do not see that they are making a game for girls in particular, but rather think that they are designing a game suitable and interesting for children with horses as their main interest.

> *At Funcom we made a game for girls, Pocahontas, and it was full focus on satisfying girls, not boys. We and Disney learned that it is wrong to think like that. When we are making the horse game, we make a horse game which should not explain every little detail about horses, but makes you able to learn about horses, and play a game which is fun for people that age. Quite easy, but not too easy. It is not for children. In Pocahontas, when aiming for the girls, we ended up with Pocahontas running around in the woods, she doesn't kill anyone, but picks and smells flowers more or less. And no one bought that game. The game most played by girls is Super Mario. In Mario 2 they actually pick flowers. Girls actually like to pick flowers (laughs). I don't believe that. And actually, the flowers you pick in Mario 2 are used to hit the enemy with* (Arvid).

Reaching girl gamers is thus regarded as difficult, and in order to get the information they need to do such work, the men at Artplant say that they depend upon their publisher. As they see it, the publisher knows the market, while Artplant knows how to make games. In addition, they have visited a stable, talked with girls there, and asked them what they would like in a game. They also test the game as they go along to see if they like it or not.

The men at Artplant do not have an explicit goal to make games for girls or children, but they said that they needed to look at a different segment outside the mainstream gamer's market because Artplant is a very small company. Most of all they just want to do what they are skilled at and what they think is fun. They want to make games, but they need to land new projects so they can survive economically. To do that, they maintain a need to think differently from the others. As a follow-up of that, they told us that they would like to make a game for housewives, for instance based on the books of a best-selling author of Norwegian paperback novels.

> *We worked for Sega once. We were supposed to make a puzzle game, and they specified that it was important to reach the housewives. They had found that housewives were one of the big markets. But, the problem is that housewives never buy the games. Or, they don't buy it for them selves. But since the*

> *game was available in the house when the sons were in school, a lot of housewives were actually playing the games, Tetris and such. I think that in order to reach the housewives, we have to start from an established interest. Go through familiar channels, not the PC magazines, but women's magazines. Make a women's magazine distribute a game and focus on role models. That's the first thing, but we do need a lot of focus testing, because they are a different group. We don't know much about them. But I believe they would find it cool. Actually, they would find a lot of the existing games cool if they only had a go at it* (Arne).

The culture and strategies of game design

When we summarise the accounts of the informants in the computer game companies, we may notice several important features that appeared to be common. First, this is a highly competitive industry. The companies are largely dependent on client funding (publishers or distributors) or public support, like we saw in the case of Caprino. None of them claimed to be very profitable, in fact, the industry came across as a kind of enthusiast undertaking. The work was supposed to be fun rather than well paid.

Second, and probably related, this is very much an industry of young men. The few women constitute a very small minority. The culture appeared to be in line with this, with the kind of masculine traits often associated with nerd-like computer enthusiasts, such as long hours of work, a lot of passionate game playing and heavy consumption of pizza and coca cola. However, several of the informants claimed that this nerd-like culture was being superseded by a more normal culture of work, because the employees were getting older and more established, with girlfriends or even family commitments. Thus, it would appear that the industry in this way has become more mature and businesslike, perhaps also more woman-friendly?

Since most of the computer game producers are young men who have been and maybe still are such passionate game players, there seems to be a strong tradition to consider themselves as representative users. This implied a marked tendency towards a conservative perception of their customers, perhaps most outspoken in Funcom and Innerloop. These users were seen as well established and well known. Ivar puts in the following way:

> *It is very difficult to make money in the girls' market. We draw on established purchase habits. In order to sell to girls, we*

> *have to establish new purchase habits. I have seen so many attempts at reaching the girls, all through the 90s. People try because they think it is a huge market. "Let's just make something they want, and they will come running to the shops." But, no, it doesn't happen. It is incredibly, incredibly difficult to imagine what girls want* (Ivar).

Ivar goes on to explain what he perceives as major difficulties in transforming stereotypical female features into design characteristics applicable to the making of computer games:

> *I see that people assume girls want something pink, flowers, clothes, petting sweet kittens and so on. It doesn't work. And if you ask girls what they want, they say more emotions, interesting personalities, stimulation and not too much violence. I've seen those products as well, and they don't work. What actually does work, because you have games that are popular among girls, like Sims, these products start with a good concept irrespective of the perceived user. They don't consider who would like it, they just have a good idea for a concept, for instance including managing a family, career, money, a house to decorate and such. And when these developers invest a lot of money in a good concept, they end up with a very good product. And then it is more random luck that girls pick it up. I think it is impossible to change that. You can't say "let's spend 100 million dollars in order to make just as many girls as boys play games!" No way. It won't work* (Ivar).

To design games for a different audience than the established was considered risky, also because new user groups were seen to need a lot of "upbringing" and guidance, and thus, new titles and themes would not automatically work to include new user groups. From this perspective, the companies claimed to have close interaction with users.

However, Caprino as well as Artplant were trying to construct new user groups, so here, there was greater diversity. Still, it is important to note that new user groups did not necessarily mean women. Children or families appeared to be a more attractive or open alternative.

When we look at the strategies of game design, they appeared to follow a reasonably constant pattern across the four companies. There was general agreement that the main challenge was to find a good story, from which a game could be made. Arvid said it like this:

> *I believe we have to make girls interested in games rather than tailor the games for girls specifically. And that brings up*

> *another issue regarding types of games. We have Tomb Raider, lady with big boobs, wars and weapons and such. Imagine making like a Playboy game for girls. It is not natural at all. Just look at films as well. Games are best based on action films. You never see like a playboy man with a nice body and tiny underwear running around. You have to have a warrior suit and stuff like that. You can't make a game based on soaps, if you get my drift. Romance and stuff like that. It has to be action* (Arvid).

It was difficult to get the informants to really specify what "a good story" was. There was something intangible to that characteristic. But as a minimum, "good stories" were usually dramatic. Very often that implied that they were violent, but not necessarily so. It was interesting to note that "soap" was not considered a good drama, from which a computer game could be designed. On the other hand, competition was regarded as drama and an alternative to violence. Clearly, "good stories" are close to the standard narratives of books written for boys or sports. It is also interesting to note that a "good story" might be equivalent to a "well-known story", as with *Flåklypa*, and partly in Artplant's strategy.

The other main challenge was to find an audience. To some companies, the audience was predefined. It was their usual gang of hard-core and casual gamers, the community that they felt they knew. To other companies, the search for potential customers was more challenging and they often depended either on publishers or distributors to help them find their target group, or they looked for an audience that already was established, like the viewers of very popular television series for children or the readers of a magazine for horse enthusiasts.

It is probably not very surprising that the dominant design methodology follows the pattern of the so-called I-methodology, where designers see themselves as typical users and use their own tastes and preferences as the basis for making design decisions. However, to be fair, the accounts of our informants suggested some important modifications to the I-methodology. First, they do some testing that involves potential users. Second, they claimed to have quite close relationships with users, at least with established users. Clearly, the Internet provides very interesting possibilities of interacting with users, at least hard-core players. Third, several of the informants referred to families, friends, established customers and business relations as sources of inspiration and information.

Arguably, neither the culture of the companies nor the main features of their game design strategies appeared to be conducive to transgress the established tradition of thinking about users either as hard-

core man gamers or as somehow gender neutral. The informants tended to make statements about women claiming that they either could be attracted to the same games as men, or that women were a particularly difficult segment because computers did not have a place in their leisure habits. Or, as Arvid said:

> *The better a game is, the more experience you need. Like Warcraft, one of the big games now. We play it a lot. I didn't understand a thing the first 24 hours. It's one of those games that don't seem fun at all unless you invest a lot of time. The point is that you just know that the game is extremely good when you receive it. You just have to learn it first. It seems like girls are not willing to spend that much time in order to get into the game. They rather stick with puzzle games, where you immediately understand what to do. But in order to learn anything from computing, you have to move on from puzzle games to larger games. Games you must install and do things with. You don't make any progress if not* (Arvid).

The absence of girls seemed to be related to the discourse about quality. All companies claimed to be designing quality games, and the informants maintained that in the end, what mattered about a game was the quality. However, it was difficult to get clear statements about what quality really meant. It appeared to be a kind of esthetical element. Games should look and feel good. The features of a game should work "properly". In this sense, "quality" was argued as a neutral or universal property of a game. There was no willingness to situate quality or relate it to particular groups of users. In the end, it was argued, quality would be the same to women as to men, and quality would work both to recruit and retain users, regardless of gender.

Thus, we may observe that the established discourse on how games should be made and the definition of quality worked to make it difficult to design computer games particularly for women or girls. Moreover, the widespread belief that, in the final instance, women would appreciate the same games as men, meant that this discourse was not seen to be unfriendly towards gender concerns. In a paradoxical way, the general idea was that inclusion of women was about making better games, not games for women.

The gendered construction of game players

While quality was presented as something gender neutral, all the informants agreed that the playing of computer games was gendered. They recognised that men dominated game playing, not just as customers

but also because masculine fantasies are given a lot of space in game design. The ease with which the informants commented upon gender issues related to game playing suggests strongly that there is a well-established discourse within the computer game community about the gendered nature of this activity.

> *The games for girls and women in Flåklypa don't have any protagonists. You can pick flowers and nice things like that. Women prefer such types of games, puzzle games, flowers, labyrinths, solitaire, Tetris. Rather that than Ride on the Mountain and the car race. At least that's what I prefer, to puzzle rather than action and competition. Car race and such is more typical for boys, so I find that we have a rather even distribution of activities for girls and boys in Flåklypa. Girls are more engaged in things they are interested in, which of course is love and such, conflict resolution, friends, personal relations, and not competition or victory. Boys and girls have different needs for entertainment, and it is important to cater for both, just like we have done in Flåklypa* (Christine).

Despite such well-established discourses about gender differences, the widely held assumption that computer games are essentially masculine was frequently challenged, in accordance with their thinking about quality. The informants were generally aware of recent surveys, which claim that the proportion of women players is much larger than has been maintained in the public debate. They took this as evidence that available games were attractive also to women, maybe due to their "quality".

> *Just look at my wife, she typically prefers strategy games. I'm not sure if I should label strategy games as girl's games, but I do believe many girls, many of her friends, have a common interest in games. And Sims, which is strategy but also somewhat Big Brother-ish. Role-playing type of games* (Artur).

Even though the designers did observe women as gamers, they would agree that the computer game discourse was gendered in a way that made it masculine. Men had greater visibility and more influence in terms of the choice of stories from which games would be designed.

There was a strong belief in the fruitfulness of making cross-generational and cross-gender games. The scepticism towards designing games especially for women was very outspoken, though. The dominant idea was that women should be reached either through games for children (i.e., games suited for girls as well as boys), games for "everybody" or even through products designed basically for a male audience. As previously noted, some of the informants made explicit

reference to the experience of making *Pocahontas*, a computer game targeted explicitly towards girls. This was considered a failure and evidence of how difficult it was to design something particularly for a female audience, which to some degree also meant a new audience.

When we looked in some detail at the way the informants constructed gender, we found that they tended to transgress the simple binary dichotomy of men versus women. In their accounts of men game players, we could identify at least two different versions. First, there were the hard-core gamers who played a lot, but who were not considered very interesting as a market because they tended to buy few games. Thus, in terms of market potential, it was the second group of men – described as the casual gamers – who were most interesting. This is the group of boys and men who play now and then, but who are not intensively engaged in game playing.

In the computer game discourse, it is more common to talk about boys than men. To some extent, this is probably a trivial expression of the fact that computer game playing is a rather recent phenomenon. The men most comfortable with game playing are the ones who have grown up with this activity, and who are still so young that they like to consider themselves as boys. This also implies that they still may spend much time playing games, a masculine trait generally recognised by our informants. They also agreed that boys tended to be most interested in action games, in particular so-called first person shooting games.

Their ideas about women game players were more contradictory. On the one hand, there was the large group of "traditional" women gamers. They were perceived to be influenced mainly by conventional feminine values and activities like social relations, romance (availability of flowers and candlelight), emotions and personality. According to our informants, this group of women were fascinated by games based on role-playing and/or strategy, and they were concerned with conflict resolution rather than violence. The iconic example of a game that satisfied such requirements was, not very surprising, *The Sims*.

Also, the "traditional" women were seen as having a limited engagement in games, because they had different priorities than men. They would rather spend their money on other things than games (which implied that the price of a game would be an important feature), they would get little positive feedback from peers for their computer skills (perhaps even negative reactions), and they would prefer to use their leisure time for other purposes. Our informants meant that girls would rather be with their friends than play games. Also, women tended to feel that they always should do something useful.

However, the informants also argued that there was a smaller, different group of women gamers that perhaps could be labelled "post modern". These women would play violent games as much as and as good as boys/men. On the other hand, the informants tended to see the game playing of this group as part of relations with boyfriends or spouses, so again the interest in games would be a secondary thing. Arvid described it succinctly:

> *Take my girl friend. I've often tried to make her interested in games. When I've forced her to really give it a go, don't give up after an hour, give it 24 hours, and then you can tell me you don't like it. Every time I've done that, she's been just as hooked as I am. Like Command and Conquer, a war strategy game. It is all about wars. She was the one playing day and night, playing the game over and over again. The same with Zelda and the other games I've introduced her to. So, actually I think it has a lot to do with channels. That you have someone to be interested together with* (Arvid).

Despite not regarding girls as crucial gamers, the computer game industry is concerned with the issue of gender, not the least because this is very much related to the potential size of their market. However, it seems as if the female gender(s) are a puzzle, and even if the informants tried to avoid using the simple dichotomy of men and women, they nevertheless frequently invoked rather simplistic stereotypes in their reasoning around the subject.

This was perhaps most evident from their perception of the gendered distribution of skills. In general, they saw men as more skilled in how to master a game than women. In particular, women were described as lacking in network skills, compared to men. This was explained mainly in two ways. First, women were seen to lack the time needed in order to acquire "advanced" skills. Second, since few women apparently play games, they had relatively less access to information from skilled friends. Skills appeared to be a dichotomous feature, a clear example of how a gender dichotomy is turned into an hierarchical relation (see Faulkner 2000).

If we analyse the relationship between our informants' understanding of gender and the design of games from the perspective of co-construction of gender and technology, some rather interesting features appear. First, it is clear that they are most comfortable with familiar or established masculine tastes and practices. These tastes and practices, it seems, are easily translated into games for boys, like first person shooting games. It is all about finding the good, familiar story and audience, usually in accordance with "what I prefer". Since their

games do sell, it seems like these co-constructions appear to be working smoothly in the masculine part of the spectrum of established players.

Second, it is equally clear that the designers we interviewed were not comfortable with feminine tastes and practices. Above all, they were nervous about what they saw as the strong feminine tendency to be disinterested in computer games. Largely, it seems like they use this observation as a kind of excuse to avoid the exploration of feminine tastes and practices, and the challenge of translating them into something that could be considered as games for girls or women in particular. Here, the practical aspect of the co-construction is resisted, namely to explore how constituencies of women gamers may be constructed by using non-stereotypical assumptions about their interests to make different sorts of games. In fact, the informants tended to use a quite traditional and well-known argument. Computer games are ok; it is the women who need to adjust.

However, and this would be the third point that modifies our second one, they do to some extent try to construct games that may be considered more attractive to women. In this manner, they do not claim to design gender neutral games, because they remain aware of the gendering of tastes. Rather, they aim to provide games that may be considered trans gender. The most obvious space for trans gender games seems to be in the area of children and family activities. Here, we have observed efforts to design games that represent a bundling of masculine and feminine tastes. Note for example in our previous description of the efforts behind Caprino's game *Flåklypa Grand Prix* how the informant emphasises that some of the activities in that game, the games within the game, so-to-speak, were designed to cater for girls' assumed tastes, rather than boys'. Thus, these game designers do enter into co-constructions of femininity and technology, but only as a partial and small-scale effort.

Thus, in many ways we are left with the impression that if our informants had dared to do so, they would join in with professor Higgins in *My fair lady* and sing: "Why can't women be – like men"! This seems to be the ultimate "wet dream" of the computer game industry; evident from the cheerful way our informants talked about those women that nevertheless seem to enjoy the same kind of games as boys. However, we should perhaps recognise that the gender categories with respect to computer games may be less stable than usually assumed. Kerr's (2003) observations concur with what our informants claimed, namely that quite a lot of women seemed to acquire a taste for "masculine" games. To be fair, the claim that for example first person shooter games are essentially masculine is – essentialism. Here, we definitely need more research.

Strategies of inclusion and the co-construction of games and gender

Reasoning from market realities, the computer game industry is definitely interested in getting girls and women included among their customers as frequent users of games and enthusiastic players. However, as we have also seen, there is considerable ambivalence and ambiguity towards the development of inclusion strategies towards women. There seems to be two main sets of reasons that are offered to explain this. First, there is an outspoken scepticism towards designing games that are labelled as designed particularly for girls or women. This doubt is argued from experience. As already mentioned, the main negative incident referred to by our Norwegian informants was the game *Pocahontas*, with which several of them had been involved. This game was considered as a definite failure. Further, the scepticism towards girl's or women's games appeared to be mainly based on a disbelief that there would not be a sufficiently large demand for such games. However, there might also be some anxiety related to the ability to translate femininity into games in a way that the designers would consider to be of "high quality".

The second set of reasons given for not making feminine games stems from the claims made by our informants that the number of women game players already was considerable, in particular related to online games. Thus, maybe this kind of gendered design was not really necessary either. Rather, as we have seen, the preferred strategy was to introduce more options in the games in order to make them more trans gender, either by having feminine games within the overall game or to cater for feminine tastes alongside the masculine tastes to facilitate a greater variety of game behaviour. However, this strategy did not appear to be very well developed.

Still, there were some additional explicit ideas about strategies that would promote the inclusion of women into the community of computer gamers:

- The informants were quite unanimous in their argument that "high quality" of games would make them attractive to women as well as men. For example, the use of well-known stories as the backdrop of game design was assumed a road to success in this respect. However, as already noted, it was never made quite clear what was meant by "high quality".
- It was also considered an effective strategy to focus on role-playing and strategy games. Such games were assumed to work to get more women into games. However, this was not thought about as an

inclusion strategy particularly for women. Basically, it was an inclusion strategy for all, women included.

- Some informants thought that one could utilise the potential flexibility of interpretation of games when designing the packing of games. It was argued that attractive packing could be more effective than a change of content to get women interested.
- If one should design games particularly for girls and women, and the if was a big one, it would be important to work from established feminine interest. The effort to develop a game about horses was offered as an example of what this meant. Our informants were very hesitant towards experimenting with tastes, in the case of women as well as for men. The safe thing was to work from the well known.

The main aim related to the inclusion of women into the society of computer gamers, or perhaps rather the dream, was to get them interested. However, none of our informants really knew what it would take to achieve this goal. But they were hoping that it some day would be realised. In this context, we should note that inclusion was mainly considered in terms of recruitment. The problem was considered to get women to buy and try out games, not to retain them. Socialisation in terms of getting them to stay on as game players was not really on the agenda. The underlying assumption was probably that if women would just start to play, they would become just as hooked on this activity as men.

Judy Wajcman observes the early transformation of pinball games to videogames, and that this new technology "was slotted into a pre-existing male subculture and took on its masculine face" (Wajcman 1991:155). What we have observed in this paper is a more ambiguous and complex gender dynamic in computer game design. On the one hand, there is no doubt that the computer game industry is very male dominated and in many respects may be characterised as a male subculture. This male dominance clearly shapes design criteria and the ideas about "quality". However, market realities as well as political-cultural pressure intervene and put a concern for women gamers on the companies' agenda. Moreover, the gender categories in the computer game culture seem less stable than would follow from Wajcman's conjecture. Arguably, we observe a blurring of the gender binary of feminine and masculine tastes and values with regard to such games. Women are claimed to have a growing interest in what used to be boy's toys, while presumed feminine qualities are added to computer games to increase their quality "for everybody".

The outcome of this is not clear, but it seems like the call for more games for girls, forcefully put forward by Cassel and Jenkins (1998b),

may end differently than expected. While the Norwegian computer game industry has heard the call, their response is not a dualist, gender-based market strategy. Rather, they opt for diversity, partly by designing games to be gendered in less obvious ways, perhaps even trans gender, partly by creating new segments, like children or family games. We may perhaps call this a kind of gender mainstreaming in the sense that the ideal is to make games that suit both men and women by integrating feminine and masculine aspects, albeit from a grounding in masculine tastes.

Our observations also support Sørensen's (1992) argument that there is no way we can link gender to design outcome, unless there is an ongoing controversy that constructs this link for us. In the case of computer games, the gender controversy has become less clear, and we see how this complicates the characterisation of games as either masculine or feminine. We may also draw an interesting parallel to discussions about whether literature may be split into men's and women's books. Many women authors argue strongly that this difference is unreasonable and wrong; they write books of high quality for everybody. Do we allow computer game designers the same privilege?

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TRANSFORMING COMPUTERS - TRANSGRESSING GENDER? A STUDY OF YOUNG TEENAGERS

The girls and computing problem

Girls' apparent lack of computing interest has been regarded as a public problem in Norway for about 20 years. Statistical data show that teachers' lack of computing knowledge and girls' lack of computer interest and access have been relatively stable over this period. The numbers are taken to indicate that girls and computing has been and still is a problematic relation the state and schools need to remedy.

This article will focus on how secondary school pupils apply computers and what role they play in their school and every day life. That means that I will focus on their domestication of the technology and also on how they co-construct it with gender assumptions. I will also reflect on whether their domestication resembles the implementation strategies structured by the policymakers and the secondary school administrators' attempts to translate these strategies into action (see Gansmo 2002, 2003a and 2003b).

Much research conducted between 1977 and 1990 describe differences between men and women regarding computing (Canada and Brusca 1991). Computer use is stereotyped as a male activity. Gender "conscious" and aware girls thus refuse to be associated with computing (Newman, Cooper and Ruble 1995). Gender differences are not only related to attitudes, but also actual use made of computers (Levine and Donitsa-Schmidt 1995). Boys know more than girls about computing. The differences are most apparent regarding computer games and technological conceptions (Vestby 1998). Further, boys and girls are often seen to have different interests in the computer. There seems to be a general tendency that boys are more interested in computing than girls are, and that the girls that do develop an interest for computing prefer the communicative aspects of computing. Girls are motivated by present usefulness, and do not want thorough introduction to something they do not see the benefit of. The girls do use the computer if they see a use and a need for it. A typical "girls' use" is the writing room, where they write poems, diaries and stories using the word processor. In addition, girls like to use the Internet to gather information about pop- and film-stars. And they use it for chatting and e-mailing (Håpnes and Rasmussen 1997).

But, many girls do not perceive their own computer use as proper computer use. "Proper computer use" is defined as useful computer use like daddies do at work, and "proper computer users" are anti social boys

who have no friends and spend all their time in front of the computer (Gansmo 1998). The "asocial and single-tracked computer nerd" is a figure the girls in secondary schools will not identify with, both because he is asocial and because he is not engaged with the useful aspects of computing. Instead he is, as the girls see him, engaged with computer games and playing around. The girls on the other hand, find it useful to learn computing for a future working career. Many girls thus construct a gender identity through and with the help of "good girl" ideals. To be clever at school, which also includes being clever at computing, is something to strive for. Hence, ICT becomes a part of their gender identity construction, because this construction happens with a reference to the ideal of the "good girl" and to the modern, competent woman with higher education and a job (Kvaløy 1999). This strive to be a "good girl" goes along with a perception of the computer as a boring but useful tool, a conception that does not trigger the girls' ICT enthusiasm. Girls with lower ambitions for their school work and future career, and girls with other more varied and hands-on experiences with computers on the other hand, were more inclined to learn computing because of a less binding idea of "proper computer use" (Gansmo 1998).

Still, boys are more likely to view the computer as a *toy*, while girls are more serious in their approach to the *tool*. Further, computing is likely to be a tool which has nothing to do with feminine peer socialisation. Although many of the girls display high levels of computer sophistication in front of the computer, their expertise is seldom heard to be a topic of conversation among friends (Orleans and Laney 2000). The same can probably be said about families. Within families both parents and siblings often regard sons as computer experts while daughters are seen as computer illiterates, at the same time as these girls actually prove to be very competent, only less competent than their brothers, which again may affect these girls' self-perceptions in relation to computer use and knowledge (Sutherland et al. 2000). Boys more often than girls apply an expert repertoire when talking about computers, while girls mostly apply an outsider repertoire. Instead of posing themselves as experts, girls are more down to earth in their conversations about computers, and they also present themselves as less of an expert than the researcher actually found them to be. Accordingly, boys frequently posed as more of an expert then they were (Volman 1997, see also Vestby 1998).

Research findings are thus rather consistent in showing that boys are more interested in, have better access to and make more and also more varied use of computers than girls do. Hence, girls are predicted likely to become the new losers in connection to ICT (Rudlang 1995). And the low number of girls and women taking an interest to computing

both professionally and in their leisure activities are thus seen as alarming (Bromfield, Clarke and Lynch 2001). Adults have to guide the computer use of children in order to prevent differences between girls and boys from evolving (Canada and Brusca 1991).

Based on such consistency in the research on girls and computing, and based on a claim that young children are not simply "receiving" the construct of a the computer generated by familial or marketing discourses, but are actively constructing their own definitions of computer technology (Sutherland et al. 2000), I expected to find variations over the same gender divide in my own research on young teenagers and their understanding of computing. But, I also expected that the teens' domestication of computing would display traces of the 20 years long policy focus on the girls and computing problem.

Gender and computing as seen by policymakers and school administrators

The first Norwegian White Paper exclusively treating computing in schools came in 1983. Since then we have witnessed a development from a limited, specialist technology to a trivial but apparently crucial technology for all. The main goal seems to be to give everyone, with an emphasis on girls, access to computers, preferably through the integration of computing in all subjects and by increasing the amount of computers available, and also to increase ICT training for teachers, especially female teachers (Gansmo 2002, 2003a and 2003b).

The policymakers have complex notions of computing. Computing is trivial and advanced, tool and toy, programming and communication, useful and dangerous. These notions of the technology are mainly described in gender neutral terms. Paradoxically, the policymakers do not see the computer users as gender neutral. Boys are seen as addicted to computer games and are thus learning to be technically skilled, while the previously absent girls are seen to have entered the arena more as the Internet has developed and chatting has become more common. Thus, the policymakers see two different computing arenas – one for boys and one for girls, and girls are seen as more reserved towards computing than boys are. This means that the policymakers are co-constructing boys and girls by constantly contrasting the one category with the other. Further, even though the policymakers' initial comprehension of the technology apparently is constructed "uncontaminated" by gender, it appears that this gender neutral technology comprehension continuously is co-constructed with their constructions of boys and girls as well. Girls are seen as careful and conscientious computer users, while boys are playful, girls communicate

where boys play games, boys are experts while girls are normal users. This co-construction of gender and technology also implies a hierarchy where girls' computing constantly deviates from and is relegated compared to boys' computing (Gansmo 2003a, see also Faulkner 2000). As long as gender is comprehended in two such distinct categories, this allows for a hegemonic discourse of masculine computing values to set the standard for how to reach gender equality by making more girls active computer users, just like the boys. Normal use of computers, which girls usually are seen to be good at, is regarded as basic knowledge everyone is expected to master, while the technological, single-minded, usually masculine, computing knowledge is ranked as the highest level of skills. Actually, this type of tinkering skill is so strongly co-constructed with masculinity that the policymakers expect to be able to decode computer users' sex by evaluating their skills (Gansmo 2003a).

The actual implementation of computers in secondary school is the prerogative of the municipalities and particularly the schools, causing a possibility of multiple outcomes. The main message taken away from the White Papers seems to be that computing is important, but the schools react differently to this importance.

Some schools seem to resign by the "overwhelming" demand that all pupils must be made adequate computer users. Even though they observe gender differences in the pupils' computing, they claim to be unable to follow the requests from above due to lack of time, resources and money. Further, these resigned schools think the gender and digital divide will diminish in due course because of the constant diffusion of the technology into all spheres in society. And, since the resigned schools regard girls and boys as different by nature, it is seen as natural and unproblematic that girls are not very interested in or included in computing activities until diffusion of the technology has done its job (Gansmo 2003b).

Other schools are more doubtful followers of the implementation and inclusion strategies. They offer basic introduction courses in ICT in order to secure widespread use of ICT in the different subjects. Their implementation strategy is to gradually provide teaching through ICT in the regular curriculum. They observe some gender differences in relation to computing, but question whether it is really a problem. Some of these schools also note an important intra-gender divide, which means that to some extent they have started to deconstruct gender as well as computing. So, rather than focusing explicitly on including girls, a goal they question the relevance and importance of, they make an effort to include all pupils through basic training and gradual implementation of ICT as a tool in all subjects (ibid.).

A third group of schools may be labelled innovative due to their choice to focus more on learning through the technology rather than teaching the technology it self. They apply the technology as a gateway to learning through interactive use of ICT in the subjects, which seems to trigger and include all kinds of pupils. Thus, they do not need a gender inclusion strategy since they have an inclusion of everyone strategy. They explore online teaching, offer basic training and computer clubs after hours, and develop interactive textbooks on the Internet. But more importantly, they include everyone into the school in general. They work to build a positive identity for all through their home page, networking and a general inclusion of present and future pupils, parents and teachers into the school, for instance through being at the technological forefront with exciting projects. They do not observe many traces of gender divides, on the contrary, they experience that ICT can work to diminish some of the differences between people's abilities (ibid.).

In the remainder of this article I will focus on how the secondary school pupils apply computers and what role they play in their school and every day life. Based on previous research findings, it seems reasonable to anticipate that the teens will have clearly gendered comprehensions of computing and computer users, and that they will perform their own computing accordingly. But, I also anticipate that the teens' domestication of computers somewhat will resemble the implementation strategies structured by the policymakers and the secondary school administrators' attempts to translate these strategies into action. Thus, I choose to interview pupils from one of the innovative schools, which claim to apply an inclusion of everyone strategy, and thus see no need for a particular gender inclusion strategy. Since this school does not observe particular traces of any gender divide, I anticipate that the teens interviewed for this case are somewhat equally interested in computing.

The empirical data in this article is based on 12 qualitative interviews with seven girls and five boys aged 14-16 in one secondary school (Innerland) in Norway, where I previously had interviewed the headmistress (see Gansmo 2003b). The informants were given fictive names. All girls are given names ending with a vowel, all boys' names end with a consonant. The first letter of the name indicates in which order the interviews were conducted: A, B, C etc. Based on the informant's choice, the interview took place either at the informant's home, my office or at a cafe. During the interviews, which lasted from about 45-60 minutes, we talked about the teens' use of and comprehension and ideas about computing and computer users related to their school and every day leisure life.

Gender and computing from the teenager perspective

> *Computing is boring. It is nice to have when you have a job or if you know how to do it. But I don't find it interesting. There is nothing I would like to try. I found that out after using computers in school. We learnt where all the keys on the keyboard are. Afterwards I went home, on the Internet and spoke to other people there. The only thing I need computers for is the Internet and e-mail and stuff like that. I use that a lot. I used to send so many mails that dad told me to stop because the phone bill was enormous. So, now I only send about two every day. To friends and people I get to know through the Internet, chat groups and stuff. We're not allowed to chat in school. In school we have projects and assignments where we are supposed to learn the keyboard* (Dorte).

This quote illustrates beautifully how the teens in this case continuously divide computing in two main spheres that do not seem to be particularly related: School and leisure/home. It can of course be difficult to isolate the teens' experience from the two spheres, and they are probably somewhat related in the teens' constructions of their comprehensions. Still, it is interesting that the teens so clearly separate school computing from leisure computing, and I choose to follow this division in the analysis to get a better grasp of both constructions.

The best term to describe school computing, according to most of the teens, is "rather boring". They are allowed to use the Internet, spreadsheet and word processor in all subjects if they have a project. Several of the teens mention that they are learning spreadsheet at the moment. They find it rather stupid to type all those formulas, and feel they do not learn math through using a computer. The teens explain that even though the answers come out the same, they do not understand how the machine calculates because it goes about it differently than they would. Further, they find that math has become more boring these past months when they have been practising spreadsheet. But, some of the other subjects have become more interesting from using the computer to search for information on the Internet.

Generally, the teens do not use the computers much in school except for gathering information for different projects. Cecilie describes it like this:

> *I only use a computer in school when we have this project on France and Italy. Then we use e-mail. We don't use computers much in school. In 8th grade we had one computer lesson a week, to practice typing. But, now we only use it in projects, and that is not often. We don't have CD-rom, and we did not learn anything*

> *about e-mails and the Internet in that class, just typing. How to type with 10 fingers. We had a computer teacher and a typing program we practised on. You know, find the letters without looking at the keyboard* (Cecilie).

Dorte tells a similar story and reflects on why they are not allowed to use the computers more:

> *We don't use computers much in the normal subjects, except when we have a project. The only thing we have learnt about computers was in 8th grade when we had to learn the keyboard. It would have been nice to learn how to find different sites on the Internet, how to find the way and stuff. I don't know why the school won't let us do our home work on a computer. Oh, well, actually I guess it's because of the spell checker. You can correct all your mistakes, and then your work is perfect and you get As. But, then you haven't written the assignment yourself. If you write it by hand, they can see the mistakes we make, and then they can correct us* (Dorte).

Mainly the teens associate school computing with home work, to write an assignment, gather useful information from the Internet and make presentations with different tables and so on. In school they normally only use the computer occasionally in some subjects like math, religion, natural and social science and in music. Further, despite classifying their computing skills as average, many of the teens feel they have not learnt anything about computers in school that they did not know before. Generally, the computer really does not seem to play a central part in school. It is there along with the school books and pencils, and it is considered to be just as interesting as the pencil. Also, many of the teens find that the pupils are better at computing than teachers are, except for the computer teachers. Since they are only given very limited access to the computer lab, some of the teens mention that it would have been an advantage if the teachers knew what they were doing, because when they finally get there, the teachers often cannot make the systems or the printer work.

All of the informants have access to computers at home, except Cecilie who is "in between" computers because the one they had is broken and they are planning to buy a new one. This is in accordance with recent Norwegian research which finds that about 90% of Norwegian teens, boys and girls equally, have access to computers at home (Sølvberg 2002). According to the Central Bureau of Statistics (SSB), nine to 15 year-olds mainly use the computer for entertainment. 77% state that they play computer games or play with the computer in other ways on an ordinary day, while 22% of children in this age group use the computer for home work. This can be compared to other typical

leisure activities where SSB finds that 90% of the kids watch TV on an average day, and listening to music is equally popular.[1] The computer thus seems to fit well in with what the teens do in a normal day. And, as described by Hilde, the home computer is fun and used for a variety of tasks:

> *Computing is cool. It just is. Especially chatting. I think most of my classmates have computers at home, but I'm not sure if it is like a cool must have. I use the computer to type, find information on the Internet, and listen a lot to music. But I don't do e-mails and I have never tried shopping online. I just chat with people from all over the world, but mostly in Norway. I lie a bit about my age and make up new names. That's fun! I lie a lot, and that makes it even more exciting. And I flirt with the guys!* (Hilde)

The teens typically use the computers to play games, chat, e-mail, type their home work, find information on the Internet about popstars, games and information relevant for their schoolwork, or to listen to music. It varies how much they use the home computer. Some weeks they can be at it several hours a day, and other weeks, for instance when the weather is nice or in summer, they do not use it at all. They normally use the computer when they are bored and have nothing else to do.

What best characterises the difference between school computing and leisure computing is the difference between focusing on the technology/the task versus focusing on the relevant activity where the computer is a means. The home computer is domesticated differently and less as a technology than the school computer. For instance, learning the keys on the keyboard, which is stressed in school computing, is relevant in order to be able to communicate with people on-line, but through communicating with people on-line you automatically learn where the keys are.

Heterogenisation of computer tasks and skills

When separating school computing from leisure computing, the teens usually regard school computing as a kind of "proper" computing related to knowledge. But, several of the teens are critical towards the way computers are used in school. Ivar finds that some parents and teachers stress the importance of computing, but they stress the wrong issues. Ivar also finds that the pupils do not utilise the school computers optimally. They are mainly allowed to use the computers for projects, which means that most pupils spend their entire computer lab time on the Internet searching for information. According to Ivar, they do not learn to digest

[1] http://www.ssb.no/emner/02/barn_og_unge/2002/fritid/main.html. Date downloaded: December 16 2002.

and apply the information through writing it up, only to more or less cut and past it. Further, most pupils take this opportunity to surf the Internet for fun, just to get away from class. Thus, the pupils who need the computer training are not inspired, and the ones who know their way around computers are bored, because they already know everything the teachers can offer them. Ivar is quite harsh in his criticism:

> *Computers are left on the margin of teaching, they are not an active and natural part in teaching. You have to use them actively in all subjects. Not like: "Let's go to the computer lab and have fun!" The Norwegian school has completely misunderstood how to use computers. The Curriculum states that we have to use it. But, to pay attention to a teacher explaining step by step on the Internet and stuff, that is just too much. You never learn to be independent and to learn something on your own. It is not integrated in the school system, it is just something on the side. If you're not already interested, you're not inspired to make anything good out of it and explore it. And the school places way too much focus on teaching us Touch. We spent the first half of 8th grade learning Touch, which I already knew, and besides, the program they have is no good. The pupils aren't interested either, so they don't make an effort. It's no fun memorising the basic keys. And that's were the problem lies as well: When we only use the computers occasionally, we have to memorise the commands. If we rather used the computers a lot more in the teaching, we would learn things naturally, and not have to memorise things* (Ivar).

Ivar is not sure if it would be wise to give all pupils their own computer because he observes all the silly things the teens use the computers for in class: They download music from the Internet, play games and fool around, which also means they lose focus on the teaching. So, computers are more or less only used by the pupils to avoid their duties, they do not use them correctly, according to Ivar. Thus, neither school implementation nor pupils' application are correct, but Ivar's critique also succinctly describes the general tendency among the teens where computing is actively divided in two spheres with different content and different "spokespersons". Many teens refuse the school's definition of computing. They have domesticated the computer at home and bring their experiences to school where they oppose the "proper" computing offered to them. The teens do to some extent see the importance of school computing as proper computing. More importantly, they see it as only one of many possible applications. Through their leisure experiences they domesticate the computer in many ways. This domestication seems to be so thorough that several of the applications

are not even seen as computing per se, but rather described as talking to friends and listening to music.

Still, the comprehension of "proper" school computing may be rather dominant, but not absolute: Eva has dyslexia and thus she uses the computer quite a lot for her school work. Computing is both a tool and toy for Eva. She has learnt to use Touch, she is allowed to use the spell checker, and practices on special computer programs (Drillpro). She compares this to a computer game and finds it interesting and fun. She also uses the computer to play games and make drawings. Even though Eva seems comfortable with moving between school and leisure computing, she illustrates how proper school computing sustains higher rank:

> *Since I'm dyslexic, I got a computer in 7th grade. Then I started to use the computer properly. I used Drillpro and such. I hadn't used a computer properly before this, only playing computer games with friends and doing fun stuff on the computer, not proper computing. Games and fun computing is just to have fun, kill some time, sort of* (Eva).

According to Eva, computers are important, at least for people using it properly, that is, useful tasks connected to work and school. Computers are of no use to people who only have fun with them or do not use them for work. They might as well buy an ordinary board game in stead. Eva has the same "proper" definition of computing as Ivar, but her computing activities show that this "proper" computing is just one of several possibilities for her. For instance, computing is also seen as cool when computing is regarded as games, drawings and music (downloading Mp3 files from the Internet). Teachers on the other hand, are seen to stress the importance of proper computing, which is, for instance visiting the right Internet sites, like newspapers. Eva has also tried chatting, which was great fun, but chatting is not seen as typical computing. E-mail is not immediately associated with computing either, maybe because it is not seen as proper computer use. The notions of proper computer use might be accentuated by how the computer is tried implemented in school. The teachers stress Touch, spread sheet and proper Internet searches, while surfing on the Internet and e-mail is seen as a reward after well-behaviour in the computing lesson. Despite such divisions between proper and fun computing, both boys and girls in this case use the computer to their satisfaction for a variety of tasks, especially at home. To most of the teens school computing is seen as equally available to boys and girls, while leisure computing is somewhat more divided; girls are usually seen to chat while boys play games. This gendering can be due to differences between their own practice and comprehension of

what others do. It is interesting to note that the computer is seen as equally available for boys and girls in the classroom where they find the genders to be gathered naturally in the first place, while leisure computing, which is connected to a highly gender segregated arena, is perceived to be different for boys and girls. But, it is also interesting to note that leisure computing is seen as equally interesting to girls and boys as well, it is just different aspects of the leisure computing which are seen as more typical for the respective genders. Further, the teens are just not particularly concerned with computing per se, but what it can be used for, and thus, they apply it in many different ways. And several of these activities are not even considered as computing. Thus, this heterogenisation of computing also "complicates" the aspect of computing skills and hence opens for many skilled teens with different skills.

> *If you want to be good at something, you just have to set your mind to it and learn it. But, for instance, those who are not clever at school, they leave the computer aside too. Those who don't care about school usually don't care about computers either* (Frida).

As illustrated by this quote from Frida, all my teen informants stress that anyone can be clever at computing if they just set their mind to it, but several of them mention that being clever at school-computing might be related to being clever at school. In order to be clever at school-computing it is important to be able to type quickly. When we consider the emphasis teachers seem to place on teaching Touch and where the keys on the keyboard are, it is no wonder that all the kids mention quick typing as one way to be clever. Some of the teens also add that it is probably important to find relevant information and be good at surfing, that is, finding the right information quickly. Computing skills as the teens see it, have very little to do with programming, tinkering, hacker characteristics or boys' room competence (see Gansmo, Lagesen and Sørensen 2003). Rather, computing skills are trivial and easy to acquire through practice. Anyone can become skilled, and thus it is seen more or less as a personal choice to be included in the Information Society or not, as indicated by Dorte:

> *It's the boys usually, who are clever at computing. There's at least three boys in my class who are very, well, think computing is very fun. None of the girls. But if you're at the computer all the time, then you become clever. You can do that in everything really, just be at it. Just make up your mind that you want to be clever at computing. I couldn't stand to do that. But anyone can use the computer and be clever if they're just interested* (Dorte).

The clever computer users are according to the teens the ones who are at it all the time, and mostly boys are seen to fall into this category. This perception can be seen to be based on traditional co-constructions of gender and computing skills, but it is also interesting to note the quantitative measure of quality or skills. If you spend a lot of time on something, you will eventually be good, or you do not spend much time on activities you are not good at/interested in. Further, it is important to note that computing is deconstructed into many different tasks. This also means that there are many different ways of being clever at computing. Thus, the quantitative measure of computing skills, saying that those who spend a lot of time on computing are clever, says nothing about what they are clever at. It just signals that generally, in order to spend a lot of time on something, you must either be very interested, talented or both. The quote from Gustav below illustrates how computing is divided, and consequently that it is possible to be clever at computing without being clever at computing:

> *I'm not that good at computing. Well, I'm quite good at games, but what's inside the computer, I know a bit about that as well, but I know nothing about proper Internet work, really. It is not difficult, but to get in and that! Daddy pays through the Internet. I will never get the hang of that! I don't like to be engaged with complicated programs. But they're not that hard. It is just the bit about getting in, making home pages and so on. I don't know anything about that, that's why I call it difficult. The other programs, the ones I really know, I've been through them so many times, so that's why I'm good at them, Word and Spreadsheet and so on* (Gustav).

This heterogenisation of computer tasks and skills, and also the move away from the nerd/hacker as the most skilled, thus seems to make more room for girls as clever computer users. This can be illustrated by Dorte who claims that the least interesting task she does on the computer is to find information on the Internet, because she finds that very hard. She writes this off on the Internet access they have at home. Since computing skills are diverse and mainly regarded as a personal choice, Dorte chooses to be satisfied with her level of knowledge; she actually knows quite a lot. Further, this is not to say that she in any way is excluded from the Information Society. She has made a clear choice about how important the technology can be in her life and which aspects of the technology are important, and she blames the technology rather than herself for her shortcoming. Still, despite claiming to be rather competent, she depicts herself as somewhat on the margins of, or outside the Information Society, probably related to a hierarchisation of the heterogeneous computing activities:

> *It's pretty hard. You know, we have this complicated Internet at home. You can't just type "www.trondheim.no", but you have to go through "yahoo" (search engine) or "solsiden" (web portal) and all that. I don't find computing important at all. I do feel a certain pressure, kind of "you have to learn to type on a computer now", and "you need it when you grow up and have to find a job" and stuff like that. I don't want a job where I have to use computers. That's why I've decided to become a hairdresser. I do know where the keys on the keyboard are, and I have been surfing on the Internet quite a lot, so I do actually know pretty much about computing. I tried to find information about hairdresser education on the Internet, but it got too complicated, just a lot of rubbish, so I gave up* (Dorte).

Such claims also relate to what Monique Volman (1997) calls free choice repertoire used by girls to indicate that they, unlike previous generations, are not passive victims of gender inequality, but are able to choose freely what they would like to do. Further, the girls may apply an outsider repertoire to imply that they contribute by choice to their own partly exclusion from the apparently evermore important technological development (ibid.) Even more, such claims should also possibly be seen as criticism of the emphasis placed on computing, and particularly of which computing tasks that receive most positive attention. Because, Dorte's story indicates a tendency that "proper" computing still has somewhat of a dominance over more typical leisure computing. This may also resemble implicit traces of the more traditional gendering of computing. Thus, despite being an active and enthusiastic user of various computer applications, it may still be seen as more "gender authentic" for a girl to claim that she is not a computer user per se. In some regards we may also relate this to Computing with capital C in contrast to computing with lower case c: The teens do to some extent explain that they like to do fun computing but they do not do "proper" Computing. This is also related to the importance and relevance they find Computing to have in their present and future lives.[2]

The way computers are introduced in the teaching seems to be boring and restrictive rather than inspiring the teens. The computer is mostly applied for project work, which means finding information on the Internet. The pupils are not allowed to type their school work, which in it self seems as a paradox since the school seems to place so much stress on teaching Touch. Further, the teens are not allowed much time on the Internet, and they are not allowed to chat. Some of the teens would appreciate more computing in school, but this is mainly meant as a fun

[2] Even though the separation between Computing and computing is important for the remainder of this analysis, I find the thourough heterogenisation and deconstruction of computing even more important. Hence, I do not separate explicitly or visually between Computing and computing in the following.

change, and an opportunity to have fun on the Internet. School computing just does not seem to be a big issue for the pupils.

Ivar regards computers as very important in society and believes they will continue to grow in importance. He uses the Y2K, or the focus on the millennium bug in the news, to prove his point: computers control everything in the world, they completely surround us. We could not have survived without computers, and they are important for calculations in all kinds of jobs. Computers are also important for Ivar personally, because they will control the world when he grows up. The average boy, according to Ivar, is just interested in playing games, and is not concerned with acquiring knowledge, and thus proper computing is not central. Ivar describes him self as different from most youths because he, unlike them, is engaging with computers now in order to prepare for the future.

Nevertheless, most of the teens in some way regard computing as important, because it offers information needed in schoolwork, and because computers are used to control machines and factories. But, it is only important to learn how this works if you are to work with computers in the future. Most of them believe computers will be more important in the future, but not that all jobs will use computers. Further, computing is cool, but not an important issue among friends. And several of the teens do not think they will use computers much in their future. The two quotes below are quite descriptive of how insignificant the computer is in the teens' present lives:

> *Mankind has existed for 2 million years so I don't see what's so important about computers* (John).

> *We got a computer at home because it is good to have one. I try to figure things out on my own, or I get dad to help me out if I need any help. I don't use it much. I'm too busy doing other things. But some times we're a bunch of friends in front of the computer. Then we usually chat* (Anne).

Ivar succinctly sums up the tendency found in this case when he thinks most people would define the computer differently and according to their varied use of it; most kids would say computing is fun and cool since they play games, while adults would describe computers as useful and handy. Ivar, yet again distancing himself from the rest, describes the computer as simplifying; computers make it very simple and easy to make neat presentations compared to all the fuss actual cutting and pasting on real paper/pictures causes.

Nevertheless, computers do not play a separate role in Ivar's life either; they are intertwined in most of his activities and interests, like schoolwork and hanging out with friends. It is thus difficult for him to

rank the importance of computing per se. This is in line with the response from the other teens and also with how they manage to deconstruct the computer and co-construct it with other people and activities. It is definitely present in their lives, and present in many of their activities, but it is not the computer per se which is important, but all the activities it is intertwined in.

As indicated in the introduction of this article, earlier studies have described the teens' computing activities as gendered, and particularly that the teens understand the computer as intimately linked to gender. In this study, school computing and computing skills are not particularly gendered. The innovative school has apparently succeeded in making computing in school transgender. Policymakers on the other hand, co-constructed computing skills with gender in a manner which produced a hierarchy of skills where masculine skills were more highly regarded (Gansmo 2002, 2003a). Generally, the boys' room competence has been highly valued (see Gansmo, Lagesen and Sørensen 2003). Such a tendency is not obvious in this study. I did observe a tendency that girls claimed not to do computing even though they also reported that they used the computer for many different things, which may be related to an association between the "boys' room" and computing. But, what is more noticeable in this study is rather the heterogenisation of computing, which makes such obvious binary gender links more complicated. In relation to school, computing skills are in this study thus divided in many different tasks. Those who spend a lot of time with computers are normally seen to be clever or able to be clever, and to some extent the most eager computer users are seen to be the boys. But, skills are also connected to being able to type quickly, finding correct and relevant information quickly and easily on the Internet and several other tasks which are seen to be gender neutral. Further, all pupils, girls included, do to certain extents have access to computers in school, and computing is tried integrated in several subjects. The implementation and inclusion strategies mentioned above, do to certain extents seem to have been accomplished since the teens see school computing as transgender. Ironically, the policymakers and school seem to have succeeded by trivialising the computer and by making computing so boring that none of the pupils really would like to be identified with school computing. In contrast, we may observe that the enthusiastic inclusion to a much wider computer use takes place in the teens' leisure spheres. Leisure computing still carries some traces of dichotomous gender connotations, but these connotations do not seem to exclude girls, but rather to reflect heterogeneous understandings of computing and of gender, as is evident from the teens' comprehensions of other computer users.

Computer users as seen by the teens

When the teens describe a typical computer user, three aspects are relevant: age, gender and type of computer use. These three aspects are tied together and the teens visualise all kinds of different computer users: The typical computer user is a man searching for information, maybe related to his job; young women or girls are searching for information, chatting or playing games; anyone between 10 and 60 are seen as typical users, but boys are seen to use it most as past times, while adult women use it more for work; some of the teens see girls playing games and young men working in the ICT industry as typical computer users. As Gustav nicely puts it, computer users are heterogeneous:

> *There is a lot of different types of computer users. The ones who sit by their computers all the time, who don't do anything else, we mock them a bit at school, but not much, we just tease them a bit* (Gustav).

This is mainly friendly teasing and probably based on acknowledgement, because Gustav recommended that I should interview a friend of his who is considered to be one of these guys who are mocked. But, there are obviously no clear links between amount of computing skills and reputation, or at least several links, because Gustav goes on to describe different types of computer users:

> *If you look around the schoolyard in the breaks, you can tell from, if they stand close to a tree all alone dressed in funny clothes, then you can tell he is a bit retarded (sic). You know, you might be good at computing, I am starting to be quite good at computing, but I'm not one of those who's at it all the time. Many in my class are good at computing, very good, but they do have friends as well. And then you have the ones who sit in front of the computer all the time and don't have a damn shit (sic). Since they don't have any friends, they play games on the computer the whole time. They're computer nerds who only focus on computing. But there are many different types of nerds. You have school nerds who only get straight As and so on. The computer nerds can be school nerds too, but not necessarily. Some are very good. And then there is a lot of cool boys as well who are clever at computing, but you can't tell from their looks* (Gustav).

The teens mostly claim that it is impossible to tell from people's appearance who use computers or not, but several of them mention that they often hear the boys in their class discuss computer games and web pages:

> *Some of the boys in my class are constantly on the Internet and play games and stuff, and they talk a lot about it. Maybe you can't hear it from the words they use, but that they talk so much about it. It sounds a bit exciting when I listen to them, but I don't know what they are talking about. But, I would like to try* (Cecilie).

Volman (1997) calls this the boys' expert repertoire and the girls' outsider repertoire. But, my informants also see that girls too talk a little bit about computers, but not to the same extent. The girls and their friends do not spend a lot of time computing together, but sometimes they recommend fun games to each other, and those who have Internet access at home might recommend a cool site. Kine explains why she does not talk much about computers in school, except with this one computer interested boy she sometimes discusses games with: It is difficult to talk to others about computers because they do not have the same games, which makes it difficult for Kine to explain to the others what she is talking about.

Lars on the other hand, explains why he knows more about what boys do with the computers: Occasionally, about 3-4 times a week he meets up with his friends to discuss new games. They talk about their records and which levels they have managed to reach. But, Lars rarely hears the girls talk about games. This might imply either that girls are not interested, or that boys and girls do not talk much with each other, or if they do, other topics are more important than computers. Either way, this lack of interaction between boys and girls might contribute to rather stable and traditional co-constructions of gender and computing among the teens. Even though school computing seems to be genderless, and even though most of the teens, irrespective of gender, use the computer more or less for the same activities, there is a tendency to depict the typical leisure computer user in dichotomous gender terms. This is probably related to the fact that girls and boys do not seem to spend much time together after school, and to well established notions and co-constructions of gender and ICT. But, it is also interesting to note that even though the individual teen to some extent understands gender as dichotomous, their dichotomies are very heterogeneous both for each teen and in between the teens.

This also leads to several inconsistencies in the teens' co-constructions of gender and ICT. The interview with Gustav is a typical case of such contradictions. Nevertheless, I take this to be more due to the teens' heterogeneous constructions of gender and ICT than categorical inconsistencies: Gustav's family is portrayed in classical gender terms (see Sutherland et at. 2000). Initially he claims that his mother and sister do not use the computer at all. The home computer was a Christmas gift to the entire family, but according to Gustav only he, his

father and little brother developed any interest for it, and his mother said she would never be interested. At the end of the interview he reveals that his mother and sister use the computer to type, surf and chat. Gustav explains that he uses the computer mainly to play games, listen to music and go on the Internet, mostly to find information for his homework. Later in the interview he admits to send a lot of e-mails to friends and chat with strangers, both in English and Norwegian.

So, the comprehensions of the gendered (leisure) digital divide seem to be somewhat still present among the teens, even though their actual use of the technology is more or less the same. Gustav confirms that boys play games and girls mostly chat on the Internet, but this also leads to a need to defend his own chatting:

> *Yeah, but if you, you just kind of have to chat if there is nothing else to do. But if I got a game, I would much rather play games. I believe most boys would. And if the girls could choose, they would prefer chat. There are not that many games interesting for girls. They don't like action games, you know, the ones labelled age limit 18 and so on, but we boys do. Boys like blood and stuff like that. That's what I prefer. It doesn't have to be that much. But you must have good games with good ratings from the magazines and stuff. Quake 2 and so on. It's smart to play games that are recommended, but not the bad ones. I read magazines and talk a bit with my mates to find good games. And sometimes we go over to each other's house to play and copy the game. And then we chat on the Internet* (Gustav).

Even though all of the teens claim that computing is suitable for anyone as long as you are interested, several of them mention that there are a lot more games that seem more appropriate for boys than for girls. Based on her own experience and preference for card games, Hilde believes girls prefer other types of games than boys do. On the one hand she laughs at and denies gender differences, and on the other she points to differences between boys and girls. This is not a matter of inconsistency, but rather of heterogeneous co-constructions of gender and computing. Further, this also relates to a common claim among the teens that general gender differences no longer exist because girls who are interested can do it as well as boys (see Volman 1997, Lemish, Liebes and Seidmann 2001), and it also points to the fact that gender differences do not equal gender inequality or injustice. Further, even though boys are seen to be different from Hilde, it is the particular games, not playing computer games in it self which offer limited room for girls:

> *I use the computer to type my assignments. And when I'm bored I play computer games. If I should imagine a typical computer user,*

> *though, I see a boy. It is typical for boys to hang about computers. I don't go about it the same way as boys do. They do other things. I don't think girls are particularly interested in all that jumping in the games, excitement and such. Most of the games are for boys, motorcycles and things like that* (Hilde).

Dorte agrees that boys play games while girls do not. Boys like all the fighting and shooting, while girls prefer to chat on the Internet. Besides, it is impossible to learn anything from playing games, while you actually can learn about other countries and so on from the ones you are chatting with on the Internet. As many of the other girls, Dorte thus disregards the boys' room competence, and maintains that girls can be equally as clever as boys even though they might do different things (see Drotner 2001). Kine on the other hand, plays a lot of games and also claims that it is possible to learn for instance English from playing an English game.

Since most of the available games have a lot of fighting in them, according to Lars, mostly boys play games. Younger girls can play Barbie-games, while older girls either lose interest or play the same games as boys. The teens find that if girls know a little about computing, they may be just as eager using the computer as boys are. And Kine agrees:

> *It is not true that girls don't play computer games. I have played a lot. But that might be due to my brother being at it all the time, that I developed an interest through watching him. But, it also depends on what kind of games that are available. Most games are made for boys, with a lot of fighting, which girls don't like. I play adventure games and strategy games. There's not much fighting and violence in them. My brother and I like the same types of games. So, it's not all true that boys like violent games. He does play some violent games, but he prefers games where he has to think a bit and so on. It varies how much I play. It can be weeks between, and then I can play every day. I usually play by my self, but it is rather fun to link the computers we have at home* (Kine).

The comprehension of computer games are thus still somewhat gendered. Many of the teens think it is mostly boys who play, and this seems to be related to their comprehension of the violent content of the games. But, this also demonstrates the potential of social learning: If you know people who play, you also learn more about how to play, and particularly that there is a variety of types of games. More experience thus works to reduce the impact of gendered comprehensions, and thus makes more room for girls as well. Further, the teens regarded computer skills as equally open to boys and girls as long as they were interested and set their minds to it. The same goes more or less for the typical

computer user as well. Even though the teens did describe the typical computer user somewhat in gendered terms, both boys and girls were seen as computer users, but as somewhat using different features of the computer:

> *Girls too can surf the Internet, which they don't do, because I don't think they do much. But there are no differences between boys and girls, there are no limits. But there are differences in mentality and self confidence. Imagine if you come a cross a warning on the Internet. Either you ask your father what to do, or you just press the keys and see what happens. Girls too can have this kind of mentality, and there are differences between boys. The more comfortable you feel at the computer and with your own abilities, the braver you get. And that might depend on you being a brave person not afraid of challenges or that you spend a lot of time computing. To feel comfortable you have to master it. You need to know how to use it, not just to start Windows and start a game. If you feel able to sort things out, you feel you master the computer. It's just a feeling of knowing how to. Nothing else* (Ivar).

Thus, despite some constructions of gender differences, most of the teens are eager to dismiss the above mentioned gender hierarchy previously seen to be intimately linked to ICTs. Through transforming computers into vast possibilities of different applications mainly related to their normal everyday activities, the teens seem to transgress towards dismissing rigid dichotomous gender comprehensions:

> *I can't see why there should be any difference between boys and girls. What's it to be afraid of? It's just a big box* (John).

Boys and girls both use computers to varying extents and for various purposes like surfing, chatting and playing games. In the teens' ICT practices there are no differences that are clearly gendered. Additionally, all of the teens refuse that there are any explicit gender differences related to computing. Every one can use computers equally well and much if they set their mind to it. That is, there are no differences in quality between the genders according to the teens. Differences in interests on the other hand, is common and accepted. While their own practical use of the computer is seen as "natural" and genderless by the informants, that is, not informed by gender stereotypes or inequalities, they do claim to observe gender differences in how others use computers, or at least how they think others use computers.

When I challenge the informants on gender differences, their answers are more evasive than categorical. Few, or none offer answers like "that's because girls are like that and boys are like this". Rather, the answers are characterised by their observations and experiences: "I don't

know any girls who play games", and "girls in my class are very talkative". Such observations are clearly influenced by and influencing their constructions. But, the point here is that the answers are characterised by heterogeneity, rather than inflated categorisations, and co-constructions rather than narrow constructions, as the quotes below illustrate:

> *Sometimes it might be that girls do not dare to press all the different keys, because they are afraid of destroying the computer. It might be that they feel like this to begin with, but after a while they just go ahead. Boys aren't so careful, at least some of them. There are differences between boys and there are differences between girls* (Eva).

> *Boys are sort of a bit more interested in technical things, girls just don't have the same interests. The way I see it, boys get to know a bit more computing before the girls. The boys are the first ones who have computers and Internet and such, and then the girls come along.* (Frida).

> *I think it depends on your childhood, whether you have tried computers and so on. A few boys and girls in my class do not understand computers, because they have hardly ever touched one, they don't have computers at home. If you grow up with computers, you sort of know a little bit about how to use them* (Lars).

> *Boys are a bit more eager, you know, on things like computers. It is just like girls and football. They are not that clever when they first get started, but after some practice they get quite good. It's the same with computing. They wont get just as good as the boys, but quite good. I don't know why girls don't get started earlier. They are probably not interested. Some of them are, but some of them probably just go into town and so on* (Gustav).

Thus, time perspective seems to be of relevance when the teens explain the difference between different users. Some boys are seen to get a head start, which sort of reinforces it self through the network of computer competent boys that evolves. Depending on girls' relation to such networks, they may be able to benefit from it. Kine illustrates this when she explains that other girls are afraid they might break something on the computer if they hit the wrong key, while she is not afraid because she has benefited through social learning from her brother's "computer network". Kine reckons that the boys do not have the same fear, because they started earlier to use computers, and also have learnt through observing what parents and friends are doing with the computer. Thus, boys can learn from a larger network of computer interested or

experienced friends, according to Kine, who learns from her brother and his friends. Her girl friends have not had computers for very long and are not particularly experienced or clever. Thus, Kine does not benefit from her female network, but they may benefit from knowing her. Another benefit from participating in networks across gender divides is that the teens are able to reveal and reject traditional and widespread co-constructions of gender and ICT, as Kine illustrates:

> *It is not true either that girls only chat and boys only play games. The boys spend a lot of time on the Internet, and my impression is that just as many boys chat on the Internet* (Kine).

This also contributes to clarify the double edge of the teens' denial of gender differences; that they deny gender differences simultaneously with pointing to them: The girls deny that boys are better qualified due to their gender per se and claim that girls and boys have the same possibilities. But, the teens do observe and acknowledge differences in interests. That is: It is accepted to develop different interests and somehow tie these to gender - gender differences - but that is not the same as gender inequality or injustice, because the teens refuse that the either sex has better qualities or more advantages than the other, as reflected on by for instance Cecilie:

> *I don't know whether it is true or not that boys play games while girls chat, but I do actually reckon that it is mostly girls who chat. That's what I imagine. Boys are on the Internet too, but I guess they don't chat that much. They rather look for information. I don't play that much myself, very little, but that's probably related to interests as well* (Cecilie).

The interview with Cecilie, as well as the above mentioned explanations from Gustav about his mother and sister, also demonstrate the strengths of qualitative interviews regarding associations and meanings of computing, and also the possibility to contradict quantitative surveys' findings that girls rarely use computers or play computer games: Cecilie starts out by saying she does not play games, and as the interview goes on, she reveals more and more game playing experience, and that she actually thinks it is fun:

> *I play solitaire and mine sweeper, and I've tried something called, it's not a shooting games. I've tried that as well, but that was no fun. But I've tried car games, and that was fun! My two years younger brother has a lot of car games, so I was tempted to try. It is quite good fun, but I don't want to spend all my time on games. My brother mostly has car games and shooting games. I don't think you can learn anything from playing games, if you're just at the same game all the time, you don't learn anything. But you can learn from*

playing quiz games. They are fun! I don't have one my self, but I use to play it at a friend's house (Cecilie).

The end of computing?

The bottom line is that the teens see everyone as computer users. They believe that computers are used in most jobs, but it is impossible to tell from people's looks whether they use computers or not, unless they carry a laptop around. Some people, boys and girls, are seen to spend all their time computing because they think games and the Internet are fun. The teens reckon that it might be that these people are nerds, if they spend all their time on it, but they are not sure if the term nerd has anything to do with real life. Nerd is a term the not so clever ones use about the very clever ones, maybe out of envy, according to these interviews. Some teens dislike the term because they feel it has a negative ring, while it is not necessarily negative to be computer interested. But, these interviews also clearly indicate that the teens actively reject the apparent prosperity of "proper" computing, and to a certain extent also the hierarchy of computing tasks, particularly related to boys' room competence.

The teens are aware that computers used to be associated with nerds, which they no longer are, since anyone can use computers, according to most of the teens. This also leaves computers as a non-issue, and they are definitely not regarded as cool "must haves" since anyone from the "coolest guy to the one on the bottom of the social hierarchy" can have them. But, having the coolest and newest games tends to be an issue among some.

I take these active rejections of the nerd stereotype, and particularly the lack of references to nerds and hackers in the teens' computing practices and co-constructions of gender and ICT, to show how naturalised the computer has become in their everyday lives. The computer is so thoroughly domesticated into the teens' normal leisure activities that is has become more or less invisible. The rapid and wide spread distribution of ICT in most homes and in school, and the fact that the teens in this material were almost born to be on line (they had not yet started secondary schools when the Internet "exploded" and became a natural must have in all secondary schools), contribute to demystify and drastically lower the importance of the nerd, and also to demystify and thoroughly domesticate computing.

This case has further shown the multivocality of the teens in their constructions of computing and co-constructions of gender and multiple computing possibilities. The teens are thus rather included in the Information Society through redefinitions than through policy strategies and school implementation. This is something else than a diffusion

process of computers and orders to implement them, but more of a translation process where computing and gender are heterogenised. Thus, the official inclusion strategies do not seem to work. They speak with a unison voice about the computer and the girl and the boy, which means that they do not get through to the teens who speak back with multiple voices about computers and gender.

Computers are a natural and trivial part in the teenagers' life. They have managed to domesticate the computers in a vast variety of ways. There seems to be constructions revolving around Computing with capital C and computing with lower case c, which again are constructed around school/work versus leisure, which again is associated with boring versus fun. Computing with capital C is associated with learning to know the keyboard and Touch, finding information on the Internet and project work which includes Internet searches for information, typing and publishing programs. Further, school Computing is mainly useful, but it can also be used for fun when they are allowed to use the computers as a treat or when they manage to convince the teacher that they need to use the Computer and actually make use of the computer.

Leisure computing is either constructed as fun, uninteresting, to a small extent as useful, and more interestingly, as non-computing. Leisure computing includes simple, fun or violent games; chat/e-mail communication with real life friends or foreigners, which offer a chance to learn a foreign language, to learn about another country, and to have fun, and also to gain necessary knowledge in order to play games; information about useful issues, games, and popgroups; typing; and finally music, which is not even presented as lower case computing. Listening to music is just something you do in addition to other tasks, something going on in the background. Further, listening to music is a gender neutral activity extremely central in teens' lives. To listen to music downloaded from the Internet is one of the main activities for many of the kids. This is a new way of using the ICTs which give skills we have not thought about as computing before, and which the teens do not even regard as computing either.

Whereas the Digital Divide literally has been understood as digital in the sense that either you do computing or you do not, or you are either a female (non-) user or a male user, I now claim that we are about to reach the end of computing and thus also the end of gender! The teens in this material deconstruct and domesticate computing so thoroughly that it is no longer a question of either being a computer user or not. They rather do some Computing here and some computing there, and furthermore, some of this computing is not even regarded as computing as such. When there is no either/or in computing, this also complicates a possible association of computing to a fixed binary comprehension of

gender. For these teens computing is no longer strongly associated with masculinity. Rather, the teens show that different aspects of masculinities and femininities are equally much associated with computing. This is not a matter of immature refusals of gender inequality. Through their practices, and also to a large extent through their co-constructions of gender and computing, the teens demonstrate heterogeneous comprehensions of both gender and computing. And thus, the gender divide disappears as such because there is no either/or in computing connected to one rigid either/or male/female. The teens may thus be seen as representatives of a seamless web in which they have managed to transgress troublesome dichotomies. Probably, we have not reached neither the end of computing nor gender, but this article should definitively be taken as an indicator that we are about to reach another phase, particularly related to teens' everyday use of computing.

Despite the negative or boring constructions of school computing, the Innovative school may have played an important role in the demystification of the computer. Through including all pupils as computer users, some of the strong gender constructions may have faded away. In this regard, State feminism, claiming that girls must be included in the computing education, may be seen as a success. Seen from the technological point of view, and thinking of enrolling more female students in higher level computing studies, the evaporation of the gender constructions may cause a problem because the technology constructions are forgotten in this process. School computing, which is seen as related to future education in or jobs within ICT, is left as "excludingly" boring and trivial for these teens. Thus, there is no guarantee that the dismissal of a digital divide in teens' everyday use of computers will contribute to a similar dismissal of digital divides in the computing professions.

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OUT OF THE BOY'S ROOM?
A critical analysis of the understanding of gender and ICT in Norway[1]

Helen Jøsok Gansmo, Vivian A. Lagesen, and Knut H. Sørensen

State feminism, the hacker and the digital divide

The widespread worry that information and communication technology (ICT) would give rise to new economic and social differences – a digital divide – is supported by evidence of how access to and knowledge about ICT follow a well-known pattern of inequalities across countries, income, education and gender (see, e.g., Norris 2001). Norway has tried to cope politically with this challenge in relation to gender. In this paper, we discuss some of the underlying assumptions behind this strategy and how it relates to research on gender and ICT. The analysis is based on a recent review of such research (Berg et al. 2002, see also Gansmo et al. 2003). A main finding was the important role attributed to the stereotype of the computer nerd or hacker as an ordering device in the discourse on gender and ICT. Here, we will explore critically how this focus has shaped research accounts as well as political strategies in the ICT area. What is it about hackers that make them reappear in considerations about ICT and computer science over and over again? And why is it that the hacker figure seems to signify an enthusiasm for computers that may be admired but also have to be denied, at least when one is concerned with issues of gender and ICT?

As a point of departure, it is fruitful to characterise the gender and ICT policies as produced within a regime of feminist politics that Helga Hernes (1987) has described as state feminism. State feminism means a focus on getting public policy instruments used to achieve gender equality, for example, with respect to development and use of ICT. Such efforts are not just performed by politicians; they may also be a part of ordinary tasks done by public employees. In the Norwegian setting, state feminism has since the 1980s become increasingly influenced by a feminism of difference that emphasises that men and women are different, and that women represent values and perspectives that complement men's (see, e.g., Bacchi 1996). We will look into some consequences of this view in relation to the understanding of the digital divide problem and the efforts to resolve it. The analysis will focus on education. Here, efforts to provide inclusion of women into ICT have been manifest.

Surveys find a high level of access to ICTs among women as well as men in Norway, but also that there is a gender gap.[2] This gap is most

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pronounced among the middle-aged and the elderly. Gender differences are larger in relation to use, but women have increased their engagement with PCs and the Internet considerably.[3] Nevertheless, this situation is not evidence that state feminist strategies have been successful, but rather that there has been a strong tailwind, stemming from a rapid process of diffusion of important ICT artifacts. Thus, conditions for achieving inclusion of women into ICT have been good. This has been described as a consequence of a 'communication turn', which refers to the change in the utilisation of computers to include an increasing accent upon communication activities (see, e.g., Nordli 2001, 2003).

In spite of such positive changes, the idea of a gendered digital divide has been retained more or less unchanged. This is due to an emphasis on particular cultural and symbolic features of ICT, expressed through frequent reference to a masculine stereotype first described by Weizenbaum (1976) as 'the compulsive programmer'. There is a widespread usage of labels like nerd, geek and hacker as more or less describing the same phenomenon. References are also made to the symbolic 'boy's room competence', meant to highlight the computer skills (some) boys develop through their hobbyist engagement.

What interests us here is not the stereotype as such, but rather the way Norwegian feminist scholars have used it to explore and explain the relationship of gender and ICT, and how it has influenced state feminist policy-making based on a feminism of difference interpretation of the digital divide. Since the authors themselves are part of the relevant academic community, this is also a self-critical exercise. It should be noted that we have not done policy research as part of this paper, so our analysis of the state feminist approach to the gendered digital divide is based on available material.

Discovering the hacker

While an early study found that Norwegian engineering students perceived computers as gender neutral (Sørensen and Berg 1987), a main result from research on gender and ICT in the 1990s was that ICT was perceived as masculine. This change is probably due to the development of particular forms of computer enthusiasm, trailing the diffusion of the home PC. For example, Aune's (1992, 1996) study of home computers found that women engaged little with this technology. The computer enthusiasts were all men, but most men had just an instrumental relationship to the machine.

The computer enthusiasm represented by the hacker phenomenon was brought to attention above all through Sherry Turkle's early work (Turkle 1984). She characterized hackers as a-social young men, single-

mindedly absorbed in computers. However, when Aune (1992) encountered the hacker phenomenon in a sub-culture of young men, engaged in making demos and cracking codes, she was struck by their thorough social organisation, with frequent teamwork and social interaction at so-called copy-parties. Similarly, a study of a hacker group of engineering students found this all-male culture to have ambiguous gender features (Håpnes and Sørensen 1995). The men competed, but collaborated too. Hackers were thrilled by opportunities for play and entertainment but also by work and utility. What have been held to be typical masculine traits, such as hierarchy, competition, distance and control was evident among them. At the same time, traits usually described as feminine could also be found, such as co-operation, reciprocal interchange, care and tolerance. The hackers defined their community as the most important cultural resource in their efforts to become creative and innovative computer users.

These Norwegian studies promote a more positive image of the hacker, but this has not been used to rectify the widespread, negative perceptions expressed by reference to the stereotype. Rather, as we shall see, a negative image of computer enthusiasm has been retained to a surprising degree. While reference to the hacker figure provides a potential basis for a feminist critique of a prominent computer culture, we should note the danger that frequent reference to the image of the 'boy's room' competence or the hacker may put women at a disadvantage. The image of the hacker may instigate a particular co-production of gender and computers which links computer skills, computer absorption and masculinity. In this respect, it poses a challenge to the state feminist strategy as well as feminist research.

Failure or fulfillment? Girls, ICT, and state feminist strategies of inclusion in education

The education sector has received a lot of attention by researchers as well as policy-makers as an arena where a gendered digital divide may be produced but also countered. This is reflected in the fact that gender equality in ICT skills has been an important goal for the Ministry of Education since the first plan for ICT in education was launched in 1983. The emergence of a gap between ICT competent boys and non-competent girls was to be avoided (Gansmo 2002). However, while the technology has changed a lot during these 20 years, policy-making has remained strongly influenced by a widespread use of clear-cut dualisms and simplified images of gender differences. Also, the major source of information used by policy-makers are quantitative surveys that tend to present their data in the dualist fashion female versus male, often using

rather simple and general measures of access and use of ICT (Gansmo 2002, 2003a). This seems to reinforce a traditional conceptualisation of gender.

In addition, policy-makers' ideas about inclusion strategies directed at girls seem to be constrained by a conservative understanding of ICT (Aune and Sørensen 2001). Computers should be approached seriously and employed for useful purposes (Gansmo 2002). Paradoxically, policymakers tend to argue that ICT is gender neutral, at the same time as they co-construct gender and ICT in a manner that ranks boys' competence above girls'. This shows the remarkable discursive influence of the hacker stereotype. Of course, this influence resonates with the phenomenon that many girls do not perceive their own computer use as 'proper computer use'. They tend to define 'proper computer use' as something like their fathers do at work, while 'proper computer users' are asocial boys who have no friends and spend all their time in front of the computer (Gansmo 1998). The image of the asocial and single-tracked computer nerd is a negation of their understanding of how girls should behave. However, to acquire ICT skills is important because it resonates with the ideal of being a 'good girl' and the image of the modern, competent woman who has higher education and a good job (Kvaløy 1999). Oddly enough, this ideal seems to elicit a perception of the computer as boring. The combination of the idea of 'proper computer use' and its relationship to the image of the computer nerd limits girls' freedom to explore computers (Gansmo 1998). Still, an increasing number of young girls think it is fun to play with the computer, to communicate and explore different programs and to see what happens when they push the different buttons (Håpnes and Rasmussen 1999, Nordli 2001).

Thus, the gender gap may be closing. A study of pupils in secondary school suggests that inclusion aims may have been reached, since school-based computer activity is seen to be done by everyone (Gansmo 2003b). However, the use of computers at school was considered as rather trivial and boring by both boys and girls. This seems to reflect, in an ironic way, the seriousness attributed to ICT in the state feminist strategy aiming to reduce the gendered digital divide. Computer enthusiasm and playfulness belong to leisure applications. Thus, leisure appears to be a more important learning arena than school in relation to ICT.

Arguably, Norwegian policymakers have been overly confident in schools' ability to compensate leisure activities, assuming that school duties could be as motivating as non-school play. This is a weakness in the state feminist strategy. At the same time, they have been too pessimistic in their assessment of the extent to which home computers

and Internet access have become a standard household good to be utilised also by girls. Norwegian school leaders see this more optimistically and use this perception as an argument to sidetrack the demands of the state feminist strategy to get girls more included as users of ICT. The neglect is also reinforced by the fact that this strategy is quite abstract, and little money and resources are made available to the schools (Gansmo 2003b).

As we have seen, in the development of a state feminist strategy to counter the digital divide in schools, Norwegian policymakers use the hacker concept as an ordering device, to differentiate between boys and girls, between healthy and less healthy patterns of use, and between those who know and those who do not. It seems as if the state feminist strategy has not been updated to recognise that computers no longer are mysterious; rather, they have become a trivial part of late modern everyday life.

In turn, this 'untimeliness' gives schools autonomy to make 'serious' use of computers boring. When ICT is made part of the curriculum, it is seen by pupils as less interesting and important, and it seems as if gender fades away (Gansmo 2003b). This may mean that one gender gap gets closed. Unfortunately, it may also contribute to the reproduction of a marked gender gap in higher computer science education, a field that remains male dominated. Boys may find motivation for this subject from leisure use of computers more often than girls. Trivial, boring use of computers at schools does not in any way moderate this effect; in fact, it may be reinforced. To most pupils, ICT is mainly an instrument of leisure that they occasionally use for schoolwork. As such, they observe that boys and girls may employ it differently. However, in contrast to state feminist policy-makers, they do not interpret this in dualistic terms as a distinction between male and female use, but rather as a heterogeneous set of differences caused by varying interests and influenced by gender.

Gender dualisms at work: Women in higher ICT education

Women are a minority among students of computer science and engineering, in Norway as in most Western industrialised countries (see, e.g., Wright 1997). In fact, there has been a reduction of female students in higher education computer science from the mid-1980s to the mid-1990s. Many universities have taken action to remedy this situation. In Norway, the most prominent example is the Women and Computing initiative at the Norwegian University of Science and Technology (NTNU). This case is interesting also because the initiative has been influenced by research on gender in higher ICT education. A consistent

finding in such studies has been the way female students complain about the culture of the discipline, and how they invoke images like 'nerd' or 'hacker' in their complaints. Rasmussen and Håpnes (1991) found that the women grumbled about male 'key-pressers' who always were working in front of their screens, with little interest in anything besides computers. These young men and their work ethic were considered by the female students to set standards of what it meant to be a student of computer science that the women would not accept.

In subsequent studies, women students described computer science as a masculine culture, where men students were perceived as approaching computers differently and also to have a different pre-knowledge of and preference for programming than women students. The women also referred explicitly to the image of the male, antisocial hacker when they made critical remarks about the culture of computer science (Berg 2000). Similar to what was found among girls in school, the hacker stereotype played an important role in the way female computer science students constructed gender. Moreover, it rendered certain parts of computer science problematic for them (Stuedahl 1997, Berg 2000, Langsether 2001). Although hackers were admired for their skills, the female students used the stereotype as a metaphor for everything they did not like about computing: a singular technical focus, work addiction, and total absorption in computers.

These findings were important when NTNU in 1996 established the 'Women and Computing' initiative to redress the declining rate of women applicants to the computer science engineering programme (Berg 2002). The actions included a quota for women students and advertising campaigns. To begin with, the initiative was motivated by the lack of women applicants to computer science and engineering. However, several of the actors were clearly concerned with the hacker stereotype and the potentially negative influence the stereotype was seen to have in several of the above-mentioned studies. Thus, the hacker figure played an important role in the way the problem of getting women included was understood within the initiative (Berg 2002, see also Teigen 2000).

This is particularly evident from the advertising campaigns that were a part of the recruitment programme. These campaigns may be read as radical efforts to redefine the symbolic content of computer science, criticising and even ridiculing the practice of hackers (Lagesen 2003a). It promoted – in line with the feminism of difference – the notion that women have special qualities, like being good at communicating with people, more holistic in their approaches to computers, more problem-oriented and generally more social. The campaigns emphasised that these qualities in fact made women better suited as computer engineers than narrow-minded, technically absorbed men students. In this way, the

campaigns reproduced a common set of intertwined dualisms; between masculinity and femininity on the one hand, and between machine skills and people skills on the other. This recreated a gendered binary opposition in computer science between feminine, social activities and masculine, technological performance (Lagesen 2003a, see also Faulkner 2000). The campaigns argued that the 'feminine' approach was superior to the 'masculine', an argument clearly intended to make computer science more attractive to women and to create a space for them to be appreciated as computer engineers. However, at the same time, the women students were caught in a distinctly dichotomous understanding of gender and computer science, where gender was naturalised. This posed a limit on what otherwise might have been a plurality of female choices within computer science (Berg 2000).

The initiative has been deemed a success because there has been a marked increase in the number of women students. The advertising campaign may have contributed in an important way to the positive result (Lagesen 2003b). The students interpreted the advertising campaign mainly as an invitation to study computer science and as evidence that they would be appreciated. They more or less overlooked the feminism of difference ideas expressed in the adverts. Most women computer science students appeared to be motivated mainly by good career options and the status of the programme rather than by an interest in computer science as such. This resonates with another feature of the adverts, namely their emphasis on the instrumental aspects of studying computer science and engineering. It was a sensible choice, and to be interested in computers was not necessary (Lagesen 2003a).

The 'Women and Computing' initiative did not counter the image of the hacker stereotype by suggesting a different way of being engaged with technology. Rather, the campaign chose to focus on the possibility of working as computer scientists without really using computers. To avoid the potential influence of the scaring hacker stereotype, they downplayed the role of technology and the importance of technical skills and explicitly ridiculed hackers. Thus, such radical state feminist efforts to include more women in computer science, as we observed in the 'Women and Computing' campaign, run the risk of forsaking computer science. The culture of the discipline was seen to be contaminated by hackers; the recruitment of more women was not just perceived as a goal in itself but also as a step towards making the discipline healthier and more in accordance with industrial needs (Berg 2002). To this end, the initiative chose to sacrifice rather than sanitize computer enthusiasm. The possibility to facilitate more varied and heterogeneous attitudes and relations to computers in higher computer science education fell victim to the hacker stereotype.

Instrumental inclusion or heterogeneous enthusiasm?

In this paper, we have observed some striking paradoxes in feminist research as well as state feminist strategy related to gender, ICT and computer science. On the one hand, ICT and computer science are presented in school as serious topics and career options, probably so serious that they appear as boring to many pupils. On the other, the enchantment of a deep engagement with computers, like what we find with the hacker figure, is seen as suspect. Policymakers in education prefer the serious and boring to the exciting, but suspect. This should be clear from our analysis of state feminist strategies to include girls and young women as users and students of ICT. Moreover, we have seen how frequently the hacker stereotype has been used to characterise features of ICT and computer science. It has become shorthand for a particular co-production of gender and technology that sometimes is seen to alienate women and privilege men, sometimes used to achieve the opposite effect.

Moreover, this shorthand seems to resonate well with the feminism of difference point of view, so clearly expressed in NTNU's Women and Computing initiative. Here, we see how the hacker figure is invoked, partly as a critique of current practices, partly to argue the need for a feminine alternative that may complement hackers' singular technical focus. The result is a campaign based on gender essentialisms and dualisms, but also a campaign with much more success than the more careful strategies applied to achieve inclusion into ICT of girls in Norwegian schools. Is this evidence that initiatives that openly use essentialist and dualist arguments, are acceptable as long as they achieve their aims? Is Bacchi (1996) correct when she argues that appeals to a feminine archetype are not essentialism, but rather a way to perform 'category politics'?

The answer to such questions is of course dependent on the existence of alternatives. Arguably, private sector efforts could represent an alternative to state feminism. For example, there are so-called feminist entrepreneurs; women with feminist goals that try to make a business out of designing feminine games (Cassel and Jenkins 1998). Might private sector efforts provide a more exciting introduction to ICT than the Norwegian education authorities? Could feminist entrepreneurship be an alternative to state feminist efforts?

Spilker and Sørensen (2002) identified some examples of such entrepreneurship, including the production of a CD-ROM called 'JenteROM', which aimed to make young women more interested in computers and the Internet. 'JenteROM' was designed from the idea that young women would be interested in a product that was quiet, oriented

towards knowledge, and simple to use. The design was made with explicit and negative reference to nerds. To make something women-friendly was perceived by the female entrepreneur behind 'JenteROM' as a contrast to what she believed young male nerds would appreciate. Thus, the similarity with state feminist ideas related to girls and computing is striking.

Some impact of feminist ideas was also identified in a recent study of Norwegian computer game designers (Gansmo, Nordli et al. 2003). They were asked about their strategies to provide games that girls and women would find more interesting. The question was deemed important because the designers clearly saw that girls and women represented a large market, but they would not agree that the obvious response was to make games that aimed particularly at a feminine audience. Rather, they preferred efforts that would make games more heterogeneous and thus cater for a wider variety of tastes.

While market actors have been quite successful in including women as users of ICT, we cannot conclude that this is an alternative to some kind of state feminism. Rather, the success of the private sector at least in part has depended on state feminism, as we found in the above-mentioned studies. Thus, in our opinion, the issue is not to dismantle state feminism, but rather change its premises. The problem is the feminism of difference.

What we have tried to show in this paper, is that the feminism of difference has contributed to a widespread acceptance of dualist understandings of gender as well as ICT. Women are perceived as instrumentally oriented towards ICT, and they are expected to have a sensible feminine relationship towards computers. This means that people skills are most important, while technical aspects are moved backstage. The strategies to include women as users of ICT or as ICT professionals implement this construction in their insistence that computers are serious means to an end, but nothing else.

Men, on the other hand, are perceived as potentially enthusiastic about ICT. They see the technology as important, but it is also an object of play and even deep engagement. The hacker figure has been used to represent 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 precarious masculine relationship to computers, where technical skills and technological enthusiasm are front stage, while people concerns are moved backstage. In turn, this relationship is presented as a policy problem because it creates an unhealthy association 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, so-to-speak, to be moved out of the 'boy's room' and

into a place where essential masculine and feminine values and qualities may compliment each other. Of course, this will be achieved by men and women working together, making a productive dialectic out of the naturalised dichotomies.

The problem with this argument is that it reproduces gendered dualisms that in turn help to reproduce gender differences in relation to ICT. The sensible feminine relationship towards computers leads, as we have seen, to an experience of computers as boring and uninteresting. The masculine experience of ICT as an object of play and enthusiasm is denied or denigrated. The state feminist discourse, when based on a feminism of difference, 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.

Fortunately, reality is transgressing the feminism of difference discourse on gender and ICT. Also girls and women discover the masculine secret because 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 machine one needs to learn to master. Instead, ICT offers new ways of doing interesting and fun activities. This represents a potential to undo the existing system of gender and technology dualisms, to replace it with a heterogeneous understanding of both gender and ICT. As we learn from Gansmo (2003b) and Lagesen (2003b), the generic concept of ICT is less meaningful to young people. They prefer to talk about specific activities that they perform using ICT, like chatting, game playing, e-mailing, surfing on the net, etc. The issue is no longer whether or not to use ICT, but what activities you need ICT to do. In turn, this provides a heterogeneous understanding of the gender and ICT relationship – maybe even of gender?

Thus, the important question is not about state feminism and the use of public policy to achieve gender equality, but rather how state feminism should be changed to accommodate heterogeneity rather than dualist differences. The risk of a gendered digital divide will not disappear just due to the efforts of a benevolent market. To answer this question, we need to return to the issue of 'category politics', raised by Bacchi (1996). Clearly, we need to have 'women' as a political category, but is it necessary to construct the category 'women' from a dualist understanding that invokes a feminine archetype? May 'category politics' be based on heterogeneity?

To indicate an answer, we want to juxtapose the Women and Computing initiative described in the previous section, to some inclusion efforts at US universities. The successful Norwegian initiative used a mixed bag of strategies, but the use of a quota for women in combination with a campaign to redefine the gender content of computer science were the main ingredients. The advertising campaign was based on a feminism

of difference, arguing that both feminine and masculine qualities were needed to do good computer science. However, in its dualist and essentialist interpretation of such gendered qualities, the initiative suggested that the main motives to study computer science should be rational and instrumental. Expressive enthusiasm like what was found among hackers, represented a risk to the achievement of complementarity. Some US inclusion initiatives have a different point of departure (Margolis and Fisher 2002; Roberts et al. 2002). Computer science is seen to be fun and interesting if one provides sufficient opportunities to experience this. Thus, these inclusion initiatives focussed particularly on teaching quality and the availability of female role models, and they were successful too. No need for essentialism.

The most problematic aspect of the way that the hacker figure has been appropriated in the Norwegian gender and ICT discourse is the tendency to identify this as the masculine approach to ICT in binary opposition to the feminine approach based on instrumentality and sensibility. The resulting dualism is clearly misrepresenting realities. Most men approach ICT different from hackers, but not all women do (Nordli 2003). Of course, gender is heterogeneous, not dualistic. To construct a category politics based on a view of women as essentially the same impose a highly problematic idea of a standardised gender normality.

But there is really no reason to base a state feminist strategy to counter a gendered digital divide on this view. It is possible to perform category politics without invoking dualisms. A heterogeneous understanding of gender does not mean that categories like men and women are without importance. However, as argued throughout this paper, we need to allow differences within the categories. We know that women relate to ICT in quite diverse ways, as do men. Probably, elements of enthusiasm, playfulness and fun are important supplementary motives to use as well as to develop ICT, compared to instrumental aspects like utility, career options, etc. What we learn from the analysis of gender and ICT is that the dualist understanding provided by the feminism of difference, for all its good intentions to provide equality between men and women, makes it more difficult to achieve such equality.

Notes

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[2] Statistics Norway: *Norsk mediebarometer*, table 4.
[3] Ibid., tables 7 and 8

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APPENDIX A: METHOD

Initial background investigations

Most (qualitative) research projects collect a lot of data and information which is never used in the final analysis. This information is nevertheless interesting in the process of deciding which problem to focus on, how to investigate it, and who can help me to get further in this investigation. I have investigated a lot of public documents which are not part of the final analysis, but nevertheless have contributed with important information and ideas for further progress. I have surfed the Internet "endlessly", and investigated several newspapers' on line archives, the Ministry of Education and Research's homepages, other ministries, national learning resources on the Internet, several counties' school administration, municipal school administration, many secondary school's home pages, personal home pages made by different girls and web portals for girls/women. I have also conducted e-mail interviews with some editors of these web portals. I do not intend to list all of these investigations here, but will nevertheless make a brief outline in order to describe the process.

Public documents

The public documents in form of White Papers, action plans on ICT in education, press releases from the Ministry of Education and Research, their home page with all its links to girls and computing projects and the National Learning Centre are all way too numerous to be listed here. But I do nevertheless mention them because I have spent weeks, if not months, reading them and evaluating them. I have been frustrated and disappointed, but also guided towards new ideas which have informed the progress of the remaining of my research. I list a few of the initial Internet-addresses below:

http://odin.dep.no/ufd/
http://odin.dep.no/odin/norsk/index-b-n-a.html
http://skolenettet.ls.no/

County school administration

Through the Ministry of Education's home page I found links to the county school administrations: http://odin.dep.no/html/nofovalt/depter/kuf/publ/1999/tilstand/more/index.html. I made a chance sample of five of these 19 counties, and analysed their status reports for 1998/99, which again are based on reports from the municipalities within each county. All of these reports showed the same tendencies, which of course is clearly related to the standardised form asked for by the Ministry. I noted a clear tendency to report "facts through numbers", and that there obviously are some established discourses regarding

where gender is an interesting variable or not. Some topics are of course easier to measure in regards to gender distribution, but not all topics which could have been reported in regards to gender distribution were reported in this way. Further, all counties had a subheading in the report named 'Girls and ICT' whether they had anything to report on this topic or not.

The main discovery from this analysis was thus the importance placed on numbers as facts, and that girls and computing is established as an issue everybody should report on.

Municipal school administration

Either through the county school administrations or through the schools I found under the national learning resources below, I followed links to several municipalities' school administration and information about ICT strategy. These searches did seldom provide much useful information for my analysis.

Secondary schools

Under the national learning resources on the Internet, I found in January 1999 a list of 400 secondary schools in Norway with their own home page (http://skolenettet.nls.no/dok/sn/globusen/skoler/grunn.html). I went through this list rather systematically, and found that many home pages were in early progress, several links did not work, and many schools only had a front page with a picture of the school and some contact data. Based on my initial idea to use this search as a basis for finding informants, I chose to focus on the schools which described their ICT strategy somewhat on their home page. Some of these schools described a gender focus which mainly aimed at achieving 50/50 distribution of boys and girls in front of the computer, and towards improving the girls' ICT skills through providing them with female role models or through letting the girls do what they prefer - communicate.

Since the interesting schools were spread all over the country, which would make my travel budget enormous, and since I decided to change focus from specialised innovator schools to schools likely to represent a more ordinary approach towards ICT, I left this list behind, except for one school. This school's home page was too interesting to be forgotten, because it clearly showed that it was an interactive page constantly updated and really intended for active use rather than just the one-way display I found many of the other home pages to be. This school is thus represented in the final group of informants.

Web portals for girls/women

As indicated in the opening chapter of this volume, and from the sources of the information listed above, I am a sworn computer user who can spend hours upon hours on the Internet just killing time or really searching for specific information. This also lead me to discover the growing amount of web portals

specifically aimed at women. In May 2000 I set out to analyse some of these more thoroughly. I chose 15 Norwegian and nine foreign web sites listed below.

Common for most of these sites are keywords such as health, relationships, pregnancy, fashion and career. To varying extent the sites explicitly state that they aim at women, but this is made clear through the choice of topics and columns like "women and …". Some of these sites focus particularly on the girls and computing problem. The different sites offer varying degree of interactivity or user participation. Some just list a bunch of relevant links, others offer expert panels and yet others have discussion forums on their site.

Based on the topics on the sites, we can indicate a lot about the designers' notions about their users. The topics follow gender stereotypical ideas that women are particularly interested in family, make up, hair, fashion and needlework. If the female users are seen to be interested in technology, this is presented as different technology from what men are interested in.

There are striking differences in how the different sites try to attract women as users. Some state explicitly that they are made by and for women because the Internet has been so male dominated and thus has had little to offer women (who (thus) have not been particularly interested in computing). Some of these sites are also specifically directed towards the girl and computing problem and want to recruit more women to computer engineering studies. Other sites are aimed at women "just because" women implicitly are seen to have other interests than men, and in order to attend to these feminine interests, women-only web sites are needed. A third category is web portals on general topics such as health, which implicitly attract a lot of female users without this being neither the explicit nor implicit goal of the designers.

I wondered how successful these sites were both in regard to number of hits and new users, and I also wondered which of them possibly managed to attract new users. In June 2000 I thus contacted six of the Norwegian portals through e-mail, and received response from four of them. They reported 10-15.000, 20.000, 40.000 and 400.000 hits per month and all added 'still increasing'. They know little about their actual users, and are thus dependent on their own expectations and the response they receive through mail and number of hits. Not unlike the computer game designers which I ended up studying in stead of these web portals. I changed focus because I decided to focus only on the young teens, which are more likely to be the target group of the game designers rather than the web designers. Nevertheless, the gendering of the Internet is an interesting phenomenon for further research, and for those interested I may also recommend some very interesting case studies conducted within SIGIS, the European IST-project my thesis is a part of (http://www.rcss.ed.ac.uk/sigis/public/index.html).

Norwegian web portals investigated prior to my analysis:

http://www.doktoronline.no/
http://www.libresse.no/
http://www.hjemmenett.no/
http://bryllupsguiden.net/bg/asp/
http://www.BarniMagen.com/
http://www.jentenett.no/
http://www.kvinneguiden.net/
http://www.trendmagasinet.no/
http://www.kvinneveven.no/
http://jenteporten.no/
http://www.webgrrls.no/
http://portalen.no/
http://www.jenterom.com/
http://www.vg.no/vg/kvinne/
http://moses.hive.no/ressurssenteret/femiweb/

Foreign web portals investigated prior to my analysis:

http://sheknows.com/
http://wwwomen.com/
http://www.allforwomen.com/
http://www.chickclick.com/
http://www.cybergrrl.com/netscape.htm
http://femina.cybergrrl.com/netscape.htm
http://www.webgrrls.com/wnetscape.htm
http://www.womenswire.com/
http://www.ivillage.com/

Informants

Below follows a rather thorough description of the main data collection process which makes the final basis for my study. I have chosen to include extensive endnotes to different parts of the table in order to describe my line of reasoning:

#	Position [1]	Sex	Site for interview	Taped	Main contribution[2]
	Background[3] information				
A	Manager of county school administration	M	His office	No	The most important documents, significance of White Papers.
B	Officer of another county school administration	F	Telephone	Yes	The role of White Papers
C	Officer of National Learning Centre	F	Telephone and e-mail	No	Name of important informants
	Policymakers[4]				
1	Policymaker UFD	M	His office	No[5]	History, overview, informants, personal experience
2	Policymaker UFD	F	Her office	Yes[6]	Informants, views on qualitative vs. quantitative research
3	Politician representing Labour in the UF committee	F	Noisy cafe during her dinner. Several intrusions.	No	Importance of access and recruitment. Importance of numbers in their work.
4	Policymaker UFD	M	His office	No[7]	The importance of teachers and school administrators
5	Policymaker UFD	M	His office	No	Equal access means equality. 'It is not a problem until I see the statistical facts.' Masculinisation = equality
6	Politician representing The Progress Party in the UF committee	F	Telephone	Yes	Deconstructed computing
7	Policymaker UFD	F	Telephone	Yes	How to make a policy. Importance of numbers. Dichotomous gender.
8	Politician representing The Christian Democrats in the UF committee	M	Noisy cafe with several intrusions from other politicians.	No	Politicians are strained for time and do not read White Papers because they represent yesterday's news.
9	Politician representing The Socialist Left Party in the UF committee	M	His office. No room or time to set up the recorder.	No	Importance of access. Numbers are facts, qualitative research is hearsay.

	School administrators[8]				
10	Headmaster	F	Her office	Yes[9]	Use ICT in the teaching/learning rather than teach ICT.
11	Headmaster	F	Her office	Yes	Access is not the key. No gender problem. Strategic work
12	Deputy education officer	M	His office	Yes	ICT as inclusion of foreign pupils.
13	Deputy education officer	M	His office	No[10]	ICT is deconstructed: prize for well-behaviour or valve against trouble makers
14	Headmaster	M	His office	Yes	Do not read White Papers at all. Neither computing nor absent girls is seen as a significant problem.
15	Headmaster	F	Her office	Yes	Vulnerability when dependent on ICT. Technological determinism.
16	Headmaster	F	Her office	Yes	Money will solve all problems, but have no strategy for obtaining money.
	Teens[11]				
17	Anne	F	Her garden	Yes	ICT is insignificant.
18	Bjørn	M	His living room	Yes	Cellular phones are more significant than computers
19	Cecilie	F	My office	Yes	I wonder if computers have become very trivial since my previous project in 1996-98
20	Dorte	F	Cafe	Yes[12]	Deconstructs (insignificant) computing into many different activities
21	Eva	F	Her garden	Yes	Downloads music from the Internet
22	Frida	F	Cafe	Yes	Being clever at school includes being clever with computers
23	Gustav	M	His living room	Yes	Mother and sister are described by Gustav and

					his parents as incompetent computer users despite several references to their complex computer use
24	Hilde	F	My office	Yes	Girls are included through chat
25	Ivar	M	His living room	Yes	Technological determinism
26	John	M	My office	Yes	No differences between boys and girls in school computing. At home girls chat while boys play games.
27	Kine	F	My office	Yes	Even though girls use computers a lot, they do not necessarily talk about it
28	Lars	M	His living room	Yes	No new information
	Game designers[13]				
29	Caprino, freelance designer	F	Their meeting room	Yes*	Everybody as users, base the design on familiar stories/events
30	Funcom, project manager	M	Their meeting room	Yes*	Quality and drama are the basic ingredients and then gender is irrelevant
31	Artplant, all[14]	M	Their office	Yes*	A small company must aim towards different gamers than the established designers
32	Innerloop, CEO	M	His office	Yes*	No use to create a new market for girls. Aims at the established gamers

* All interviews conducted together with Hege Nordli, who has also transcribed them.

[1] For the policymakers I have chosen to list their position rather than their names. We did not discuss anonymity in these interviews, and they were interviewed as public servants, not private persons. Still, I chose to leave their names out. Not because it would necessarily be harmful for a public servant to be quoted with full name, but because their names do not add anything to the analysis. All schools are given fictional names despite their willingness to be listed with full name – some of them even saw this as a publicity opportunity. Again, since the name of the school is irrelevant to the analysis, but also because not all schools are portrayed as equally beautiful, I chose to give them names according to their respective categories.

In agreement with the computer game designers and due to the fact that there really only are four computer game designer companies in Norway, which would make anonymity almost impossible, these companies are presented with full name.

Granting anonymity to children may cause them to think that I will ask them about "dangerous" topics or that their descriptions of their everyday lives are strange and deviant. This and the fact that some kids when promised anonymity will be put off from their eager to be heard, led me to carefully explain to the teens the purpose of both the interview and anonymity at the beginning of the interview.

Even though we discussed common everyday topics I still consider the teens the most vulnerable of my informants since they were interviewed about their personal rather than professional life, and also because they are at a vulnerable age. Further, since their full names have absolutely no significance for the analysis, I immediately after the interview assigned the teens fictional names and deleted my record of their contact data. The first letter of their name indicates in which order they were interviewed. Coincidentally I discovered that all the girls' names I had chosen end with a vowel (in case you are unfamiliar with the Norwegian names).

[2] I have chosen to add this column of main contribution in order to let the reader in on parts of the process of analysis through describing when different topics were "discovered". I try to list what was the most significant contribution from each informant in contrast to others. Several themes are mentioned over and over again by the different informants. In some of these cases I try not to repeat this "verification", but rather mention another important topic. This column is mainly based on the notes I made in my research diary immediately after the interview.

[3] These interviews were conducted in order to gather background information I could base the interview guide on, and also in order to find interesting informants. None of these interviews were intended used as empirical data and are thus not represented with any quotes, but the information gathered from these interviews have nevertheless informed the analysis.

[4] I had no problem making appointments with the informants I wanted to interview. Really gaining access is nevertheless something completely different from making appointments:

The interviews with the policymakers lasted for about an hour, which we had agreed on the phone. I felt that most of them were eager to let me in on their work, but also that they were interested in learning from me. Since I regarded them as "expert" informants, I was not afraid of influencing their responses through reporting some central research findings. I did not though report this as a corrective to their answers.

Most of the politicians were a completely different plate. Even though I had made an appointment for an one-hour meeting either directly with them or through their secretaries, they all indirectly made it clear that they expected this to go quickly. Some of them were even astonished when I reminded them of our appointment, and declared that they had not more than 20 minutes to spare, but I managed to hold them for about 30-40 minutes. In this time slot they constantly answered phone calls or engaged in discussions with colleagues or had to make a vote. They expected me to act as an efficient journalist or treated me as a kid making a nonsense school assignment.

One of the appointments was even totally useless despite me leaving all the contact data with the informant when making the arrangements. I flew all the way from Trondheim to Oslo just to be informed that the informant had gone to another part of the country without cancelling our appointment. To make up for this brush-off, I was later granted a telephone interview in stead. We had only come 10 minutes into the interview before the informant called it off because she had another appointment. This "interview" is thus not listed here. Despite being given a cold shoulder from several of the politicians, I did obtain the necessary information, and felt I gained rather good rapport with several of them, and that I reached a saturation point of information from politicians.

[5] In this interview the informant left the choice of recording or not to me saying that he would be able to speak more freely and give me more information if I did not record the interview.

[6] Even though I found the information valuable, I was not happy with the progress of the interview. I suspected that informant #2 felt she was taking an exam, or that the tape recorder made me relax so much that I did not really pay attention to what she said, and that the course of the interview consequently did not proceed as a natural conversation where I followed up on her input.

[7] In this and the next interview I chose to not use the tape recorder because of my evaluation of interview #2 which was recorded. I made a critical note on not recording though after interview #5, because I realised that it deprived me of the possibility to evaluate my own role in the interviews. On the other hand, I expect that such types of "expert" interviews are less predisposed to the bias of leading questions etc. Nevertheless, lack of recording leaves me dependent on the immediate analysis and translation of the answers the informant gives, giving me less options to find new angles in the analysis later on. Then again, the immediate analysis often seems to hold water in regards to the actual research problem. Based on these perspectives, I re-evaluated the lack of progress in interview #2, and considered that this might have been caused by beginner's nerves on both our accounts, or that I did not manage to establish a good enough rapport, *or* that she was intimidated by the recorder. I thus, or nevertheless, chose to tape record the remaining interviews where possible.

[8] The four first school administrators were interviewed in-between the policymakers, but for better readability I list them all together.

Six of the schools were chosen based on their locality within one municipality which would make access easy and affordable for me, and the seventh due to its interesting homepage. I did initially search the Internet for potential interesting secondary schools to investigate, that is, schools which had made specific efforts towards including girls, but decided that it was more interesting to see how normal schools translated the directives from the White Papers. I thus started with a list of all ten secondary schools within one municipality. I did not intend to interview all of them or to obtain a representative sample, but rather to go along as long as I felt I learned anything new. Gaining access to the informants was rather unproblematic even though some were sceptical due to time constraints and participation in other research projects. None refused to participate, but one school administrator was impossible to get a hold of, one school was never contacted due to engagement with another somewhat similar project and the last two was never contacted since I felt I had learned enough.

Upon first contact with the school I presented my case on the telephone and was then directed to the correct person according to the one who answered the phone. In a few cases this person referred me to another person at their school more knowledgeable about their ICT policy. All interviews were conducted at the schools and lasted about an hour. I achieved good rapport with all of the administrators, but as can be expected, I felt that some of them had more interesting reflections than others.

[9] Occasionally this headmistress asked me to switch off the recorder because she wanted to give me information that she did not want to be quoted on. This has not deteriorated the quality of the information.

[10] In this interview I had trouble with the tape recorder, and thus had to conduct the interview without recordings and rather take extensive notes. Looking back I realised that this school plays the least significant role in the analysis. This may be due to the lack of a full interview transcript, but I hold it more likely that this *was* the least significant school.

[11] Gaining access to teens can be a challenge both regarding to get a hold of them and then to get them talking. I asked two of the headmasters I interviewed and was allowed to distribute an "invitation" through the school. I made an information and consent letter to the pupils and their parents. I gave all contact data for my self, presented the research project briefly and without revealing too much of the gender aspect, invited the teens to participate, and asked the parents to sign the consent and list name and phone number if the teens were willing to participate. Afterwards they could return this letter to their teacher, and I collected them after some weeks.

The timing of this was not very good since I interviewed the school administrators late Spring, which is a busy time of the school year. Of the about 100 copies I asked the schools to distribute to the pupils attending the two lower classes, six and 13 were returned to the respective schools. I started to contact these 19 teens over the summer holiday and managed to make appointments with 12 of them, all from the same school. Upon contact with the boy who was respondent #13 he shyly regretted accepting the invitation, and I saw no need to push him. The six candidates from the other school were either unavailable due to summer holiday, had listed the wrong phone number or claimed that they could not remember having agreed to participate and did not want to either. After having conducted the 12 listed interviews, I felt that I did not learn much more from the last informants, and thus decided to not contact the pupils who were unavailable over the holidays. My saturation point was reached.

Access to the teens was here partly gained through "self-selection", a strategy I was a bit suspicious towards. I anticipated that mainly the pupils who regarded themselves as clever at computing would volunteer to participate, particularly if the teens comprehended the research project as a computer test. After conducting most of the interviews, I realised that most of the teens were average to good students, but not computer wizards. Thus, the informants are probably more representative of the good pupils who do as the teacher tells them (for instance to participate in this study) rather than representing all kinds of diversity found within one class. Since I did not aim for a representative population, and since I gained interesting information from and found interesting varieties among the informants, I decided to be happy with this self-selection after all.

I left the choice of where and when the interview should take place to the teens, and in a few cases they left it to their parents to make the choice. I suggested that we could meet either at their house, a cafe or in the lunch room at my department, and all of them agreed to one of these options. Of course being able to visit the teen's home gives some additional information through observation of the home, locality, and in some cases the possibility to meet and talk a bit with friends and family, but in this case that did not provide me with so much significant information that I would consider asking all teens to meet them at home.

I gained relatively good, but of course varying rapport with all of the teens, regardless of where we met, and the interviews lasted from about 40 minutes to an hour. Based on my experience with interviewing teens from my previous project, I knew it could be hard to get them talking, to say much more than yes and no. The good icebreaker in many of these cases are the pictures I start the interviews with. The teens were successively showed pictures of a computer, of girls in front of the computer and of a boy in front of a computer, and asked to give me their immediate thoughts about the picture. The pictures are also used

this early in the interview in order to avoid influencing their answers about potential gender divides. Further, rather than using open-ended questions which the method literature recommends, teens are more inclined to give extensive answers when faced with two to three opposing statements.

[12] Since this interview took place in a crowded cafe, the quality of the recording was quite poor, but I did take notes during the interview, and have managed to retrieve the essential information from the tape.

[13] The computer game designers were the easiest group of informants to gain access to. Funcom and Caprino are well-known from media, and Nordli and I have met the informant from Innerloop at several conferences on children and computing. Upon contact with these companies, we informed them who we were going to see and asked if there were any other designers in Norway. We were then referred to Artplant as well. All companies were very hospitable and we had no problem getting an appointment for an hour long meeting. But, most of them expressed that they did not think we had much to gain from meeting them. Nevertheless, we gained good rapport with all the informants and learned a lot during the interviews.

[14] In this interview eventually all four male employees, one programmer and three designers participated.

APPENDIX B: INTERVIEW GUIDES

When gathering data for this dissertation, four different groups of informants were interviewed. Prior to these interviews I made an interview guide for each group of informants: policymakers, school administrators, computer game designers and teens. I examined the policymaker's or politician's role prior to each interview and made some specific questions related to this. I also investigated all the secondary schools' home pages and based my questions around these. Thus, these interview guides were changed a bit from interview to interview. When interviewing the game designers and the pupils, the interview guide was more or less the same from interview to interview. That does not mean that all interviews followed the same progress, since the advantage of the qualitative research method is exactly to let the informant more or less lead the conversation just guided by the topics in my guide. Further, all interview guides were somewhat developed along the course due to information I gathered in the previous interviews, or due to the more practical experiences I made during the interviews.

My interview guides were rather extensive to begin with. I did not intend to ask them about all the topics listed there, but used the guide more as a remainder to myself regarding what I should listen for and in what direction I should guide the informants. Below follows a shorter list describing the main topics for each interview guide.

Interview guide policymakers

Goal for the interview: Reasoning behind the action plans and White Papers. How do they construct girls/computing/problem?

Describe your role, particularly related to implementation of ICT in schools.

Is computing important in schools? Why?

Typical computer (non) users?

Computing skills in school?

How/why have some schools succeeded in the ICT implementation?

When was girls and computing discovered as a problem? What is the problem? How to solve it? Changes over the years?

What is gender equality in schools supposed to be?

Where to you find information about girls and computing for your work?
What do you base your decisions on? Research?

Interview guide school administrators

Anonymity?

Home page

Is computing important in school? Why? What? How? Challenges?
How do you try to implement ICT in the teaching?
Computing skills?

How do you use the White Papers/action plans?
What are the most important messages in these?

Does gender matter in regards to ICT? Do you observe any gender divides? How? What? Do you take any measures to remedy these?

Interview guide computer game designers

Short description of your company, and how you develop your ideas to a published game?

Who is the typical gamer in your visions of your market and in general? Age, gender, type?

Are your games made for "everyone"? (gender neutrality?)
Different segments of gamers? What type of games for who?
Different users for PC-games, web-games, game-boxes, sms-games?

A change over time in who is the typical gamer? More girls?

How do you market your games?

How do you decide what types of games to make for who?

What are your ideas about girls as gamers? Do they play? What type of games? Why do girls to a lesser extent than boys play games?
Is it important to make more girls interested in computer games?
Have your company tried to attract more girls as gamers?

Interview guide pupils

Anonymity, purpose of recording the interview

Comprehensions of computing?
- Typically described as….?
- Picture of a computer. How can it be used? Who uses it?
- Picture of a boy in front of a computer: What does he do?
- Picture of a girl in front of a computer: What does she do?

Do you use a computer? How? When did you first use a computer? For what? What do you (not) prefer to do? Why?
Do you have a computer at home? Where, who, what, when, why?

Typical computer user?
What is a computer nerd?

Is computing important? Why?

Internet? What, how, who?

School in general?
Do you use computers in school? How, when, who, what?

School home page?

How clever are you at computing? Who are clever? What does it mean to be clever at computing?

Is computing more suitable for some people than others? Who, why?

Will computers be more important in the future? In *your* future? How, why?

Leisure activities?

Mobile phones? Who, when, why, what?

APPENDIX C: AUTHORS AND PUBLICATIONS

This dissertation is a collection of articles, some authored by me only, and some in co-operation with colleagues. Further, some of these articles have already been published elsewhere, and others are under review. Below follows a short description of the co-authors and where the articles have been published.

Co-authors

Vivian A. Lagesen is a PhD-student at the Department of Interdisciplinary studies of Culture, NTNU, Trondheim.

Hege Nordli has a PhD in sociology from the Department of Interdisciplinary studies of Culture, NTNU, and works as a researcher at NIFU.

Knut H. Sørensen is a professor at the Department of Interdisciplinary studies of Culture, NTNU, Trondheim.

Publications

Introduction: Girls and computing - what is the problem?
Author: Helen Jøsok Gansmo
Published: Not previously published

Article 1: Forget the hacker?
Authors: Helen Jøsok Gansmo, Vivian A. Lagesen and Knut H. Sørensen
Published in Merete Lie, ed. (2003): *He, She and IT revisited. New perspectives on Gender in the Information Society,* Gyldendal Akademisk, Oslo, pp. 34-68.

Article 2: Locked in dualisms
Author: Helen Jøsok Gansmo
Published: Under review for *The Sociological Review*

Article 3: Seduced by numbers?
Author: Helen Jøsok Gansmo
Published in Andrew Morrison, ed. (2002): *Researching ICTs in context*, InterMedia Report 3, University of Oslo, Oslo, pp. 185-210.

Article 4: Limits of state feminism
Author: Helen Jøsok Gansmo
Published in Merete Lie, ed. (2003): *He, She and IT revisited. New perspectives on Gender in the Information Society,* Gyldendal Akademisk, Oslo, pp. 135-172.

Article 5: The gender game
Authors: Helen Jøsok Gansmo, Hege Nordli and Knut H. Sørensen
Published: Under review in international journal

Article 6: Transforming computers - transgressing gender?
Author: Helen Jøsok Gansmo
Published: Under review in international journal

Article 7: Out of the boy's room?
Authors: Helen Jøsok Gansmo, Vivian A. Lagesen and Knut H. Sørensen
Published in *NORA* 2003, no. 3, vol. 11, pp. 130-139.