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A Cyber-feminist Utopia?

Perceptions of gender and computer science among Malaysian women computer science students

Introduction

The low and even declining numbers of women in higher compute science education in most Western countries have been linked to masculine gendering of the discipline (Ahuja 2002, Dryburgh 200 Durndell 1991, Lander and Adam 1997). This raises the question computer science would be gendered differently in a setting where th proportion of women is high? After searching for such a place, discovered that in Malaysia, women constituted about half of a students in higher computer science education (Ng 1999). Considerin that so few western women choose to study computer science, a obvious question is how come more Malaysian women do? I computer science perceived differently among these women, and if s in what way? This paper is an effort to explore such issues, above all b analysing how the Malaysian women I interviewed reasoned abou their choice to study computer science.

Malaysia – women and modernisation

University of Malaya (UM) was selected as my field site. It is public university situated on a campus in the southwest of Kual

Lumpur, the capital of Malaysia. The Faculty of Computer Science and Information Technology (FSKTM) was established in the mid-1990s. Here, in 2001, 52% of the bachelor's students in computer science and 65 % in information technology were women. 43% of the master's students and 39% of the Ph.D students were women. The majority of the faculty and all Heads of Department were women, and the Dean was a woman.

Malaysia is a former British colony and also a multicultural, multi-lingual and multi-religious society with 58% Malays and other indigenous people, 27% Chinese and 7% Indians (Mellström 2003: 21). English is the second language, widely used in business and education. The country has experienced rapid economic and technological development in the last 20-30 years and is recognised one of the 'Southeast Asian tigers'. Malaysia used to have among the strongest, most diversified and fastest growing economies in Southeast Asia (Ng 1999). Although the nation was hit hard by the so-called Asian crises in the end of the nineties, as well as the slump in the IT industry in 2001, the economy is slowly recovering. ICT has been a particular area of public promotion in Malaysia (Ng 1999) through the vision of Multimedia Super Corridor Vision (MCS) to leapfrog into the information age. Thus, ICT is seen as a key to a better future, and the authorities have strongly encouraged young people to study ICT (ibid: 144).

Particular for Malaysia is the official quota system for *Bumiputeras*, which means 'sons of the soil' and refers to indigenous Malays. This system of positive discrimination of the Malays provides them with privileges in most official areas, such as quota protection in education, scholarships, employment, training, trade, business permits etc. The programme was brought about by the government to correct interethnic economic imbalances but is a sensitive and controversial issue today (Chee-Beng 1997, Luke 2002, Mellström 2003, Ng 1999).

Malaysian women constitute a diversified group in terms of ethnicity, religion, class and regional cultures, including urban/rural differences as well as cultural variations within the ethnic groups (Chee-Beng 1997, Oorjitham 1984). Thus, one should be careful about making general claims about Malaysian women even if some common

aspects may be identified. Education has played a key role in the swift modernisation process of Malaysia and has been instrumental to promote 'national unity' (Mellström 2003, Stivens 2000). Particular efforts were made to remedy women's previously disadvantageous educational position through state sponsored, large scale entry of women into mass education and industry (Ong 1995, Yun 1984). Stivens (2000) argues that the high number of women in higher education implies that parents value education for daughters as much as for sons.

Moreover, women play an increasingly important role as political actors and in religious matters, and they also engage with regional and global feminism (Ong 1995, Stivens 2000,). Ong (1995) asserts that in particular Malay women have been made icons of modernity in Malaysia by two competing institutions: the government and the Islamic resurgence, in order to form different postcolonial nationalism. State driven programmes dictated a series of tasks for women, for instance to raise children with values such as 'efficiency' and 'self-reliance'.

> The official discourse on the modern family thus defined women's modern roles: as working daughters who could pull their families out of 'backwardness' and as housewives (serirumah) who could incalculate 'progressive' values in their children (Ong 1995:394).

This family model supported a more assertive role for women at home and raised the expectations of and granted new freedoms for daughters, wives, women students and women workers (Lie and Lund 1994, Ong 1995). However, the Islamic revivalism that emerged in the late 1970s and continued in the early 1980s produced a counter model where the Islamic discourse (*dakwa*) suggested that women should not compete with men in the labour market. Jobs that involved serving others – for example as clerks, teachers and nurses or doctors (attending women and children only) – were preferred (Ong 1995). However, the *dakwa* has become much less prominent since the mid-eightees (ibid.) A common feature of the state driven modern discourse and the *dakwa* is the centrality of women's role as mothers and wives.

Nevertheless, there is a potential conflict between the image of the relatively free and 'emancipated' working woman and the

domesticated, compliant, modest Muslim woman. According to Nagata and Salaff (1996) this has intensified the ambivalence of Malay women seeking professional careers and it inhibits a potential common sentiment of women across ethnic lines. Both Chinese Malaysian and Indian Malaysian women belong to religions (Hinduism), cultures and moral systems (Confucianism) that are potentially paternalistic and may suppress women's autonomy (Armstrong 1996, Mellström 2003, Oorjitham 1984, Peng 1984). However, Chinese as well as Indian Malaysians recognise the importance of higher education, perhaps because of their disadvantaged situations as non-*bumiputeras* (Chee-Beng 1997, Mellström 2003). Also, the Malaysian state programmes' focus on education and progress has probably influenced all ethnic groups in Malaysia. A study of student attitudes towards learning to use the Internet found no ethnic or gender differences (Hong, Ridzuan and Kuek 2003)

Cyberfeminism and technofeminism: How Western research account for women in computer science

Education has become increasingly important to young women, and this pattern transcends ethnic and class barriers to some extent (Harris 2004, Luke 2002, Quinn 2003). Thus, increasingly, the interesting issue is what kind of higher education they pursue. The fact that few women in the Western world study science and engineering has been subject to much research (see, e.g., Cronin and Roger 1999, Etzkowitz et al. 2000, Haas and Perrucci 1984, Noble 1992, Sonnert and Holton 1994, Zuckerman et al. 1991). In relation to computer science, research has mainly analysed why Western women seem to be discouraged. Computer science, at least its culture, has been claimed to be 'masculine' in a way that discourages western women (Ahuja 2002, Henwood 1998, Wright 1996, Wilson 2003). Studies of western women who pursue a career within the ICT professions have introduced concepts like the 'incredible shrinking pipeline' (Camp 1997) and the 'silicon ceiling' (Wardle and Burton 2002) to emphasise their difficult situation.

We know less about *why* the few Western women, who actually study computer science, do so. In a North-American context, Margolis and Fisher (2002) characterise women computer science students as the 'survivors of the 'boy's club' of high school computing. They were observed to be skilled and interested in the technical aspects of computing and to derive pleasure from logical thinking. Also, in Norway, an instrumentalist orientation was dominant among women computer science students, even if some claimed to enjoy computing as well (Corneliussen 2002, Lagesen 2003, Langsether 2001, Teague 2000).

Margolis and Fisher (2002) observed that coming from a 'computer nerd' family, having a computer at home and no brothers who could occupy the position of the 'family computer wizard', facilitated a computer science choice among women students (ibid: 94-95). A major influence was parents' careers, interest and support, as also found by (Teague 2000). Margolis and Fisher (ibid.) also observed the importance of what they called 'pillars of persistence' like believing in hard work rather than in talent, and exercising resistance towards the masculine hacker-culture. Similarly, Greenhill et al. (1997) observed how Asian women students at a School of Computing in an Australian university overcame the dominant hacker culture. Apparently negative factors like lack of computer knowledge, difficulty, lack of interest and men's domination of IT studies did not inhibit their participation. Also, it seemed that positive factors like the usefulness of computing and good job prospects, were stronger motivating factors for women Asian students (ibid: 394). Thus, a combination of not having a hacker culture as a reference group and a strong instrumental orientation may be important for women to choose ICT.

From a Western feminist concern that more women should engage with computer science, the situation in Malaysia looks nearly utopian. How may we understand this? Much Western research has suggested the importance of communicative aspects of computer technologies to make women interested. This is highlighted particularly in cyberfeminism, which argues that computers and computer networks hold utopian promise for women. Cyberfeminism has been developed as an alternative to pessimist and critical feminist accounts as 'a woman centred perspective that advocates women's use of new

information and communications technologies for empowerment' (Millar in Hawthorne and Klein 1999:3) The term encompasses a range of feminist thinking concerning the relationship between ICT and gender, arguing progress of women in new technological arenas such as the World Wide Web and the Internet (Kennedy 2000).

Plant (1996, 2000) offers perhaps the most prominent and optimistic contribution to cyberfeminist visions. Women, computers, virtual reality and cyberspace, she argues, are linked together in dispersed, distributed connections (the matrix) that, because of its inherent feminine character, will emerge as the new society that will destroy patriarchy. One could argue that if Plant's vision is to be credible, computer science will also have to experience an influx of women. Thus, from this perspective, women are expected to engage with the technology in a way that transcends the role of users, finding particular pleasure in the communication possibilities.

Plant's utopian visions have been criticised for lacking critical perspective, for hyping new technologies and overstating the women-friendliness of cyberspace (Adam 1997, Hawthorne and Klein 1999, Pohl 1997, Wajcman 2004). Plant's enthusiastic account may also be contrasted to Harris' (2004) critical analysis of how 'in a time of dramatic social, cultural, and political transition, young women are being constructed as a vanguard of new subjectivity. They are supposed to offer clues about the best way to cope with these changes' (Harris 2004:1). The discourse about young (all-purpose, global) girls as 'flexible, individualised, resilient and self driven and self made' (ibid:16) produced in late modernity, may be considered disadvantageous to young women because it demands so much from them and provides so little support in return. Harris' view resonates in an interesting way with Ong's (1995) analysis of how women were assigned a key role in the production of a new modernity in Malaysia by being 'efficient' and 'self-reliant'.

However, interpreted with care, cyberfeminism resonates with findings made by other researchers that the communicative capacity inherent in ICT represents favourable opportunities for women (Rasmussen and Håpnes 2003, Stone 1995, Turkle 1996). However, these studies have mainly looked at women as users of technology. As

Faulkner (2000) reminds us, observations related to women and technology may not be relevant to women *in* technology. Still, it seems relevant to explore whether women computer science students in Malaysia are particularly motivated by the communicative abilities of computer technologies.

Wajcman's (2004) recent synthesis of Western research on gender and technology presents a somewhat different position, technofeminism, which emphasises the need to investigate the gendering of new technologies. It is important to assess critically how technologies become gendered in a way that is usually to the detriment of women. Technofeminism, Wajcman argues, relies on feminist political practices in combination with feminist research to change socio-technical networks to include more women.

Technofeminism differs from cyberfeminism because the latter assigns too much agency to new technology and not enough to feminist politics (ibid: 127). Wajcman apprehends the culture of computing as still 'predominantly the culture of white American males' (ibid: 112). Despite a fairly bleak picture of the status quo of western women and technoscience, Wajcman does see opportunities for women to be attracted to technoscientific spheres when 'entry does not entail co-option into a world of patriarchal values and behaviour' (ibid: 112). Moreover, she asserts that increasing the number of women in engineering will eventually dismantle the strong relationship between hegemonic masculinity and the culture of engineering. This latter argument suggests that numbers or quantity is vital for changing gendered practices, cultures and symbols (see Lagesen 2004a for an elaboration on this point, Etzkowitz et al. 2000), implying that computer science may in fact be gendered differently in Malaysia.

While cyberfeminism and technofeminism perceive differently how computers may influence women's opportunities in society, they share certain features. First, both represent a western gaze on women and technology, based mainly on studies in western countries. Second, they assume that technologies are generally gendered and that the relationship between women and ICT, in particular computer science, is troubled. Since these theories seem to have universal pretensions with their lack of concern for cultural diversities, they have to be used

critically when analysing women computer science students in a non-western country like Malaysia (see Mohanty 2002, Ong 1995, Stivens 2000).

Nevertheless, when I will draw upon these perspectives as accounting resources in the analysis, it is also to examine some of their underlying assumptions. For this purpose, Malaysia may be a critical case. Consequently, the paper will look into whether Malaysian women students consider communication a major attraction of new computer technologies, how they appreciate other technoscientific aspects, the role of politics in getting women included into computer science, and the effect of a large proportion of women students may have on the way computer science is interpreted in terms of gender. The findings of Margolis and Fisher (2002) and Greenhill et al. (1997) also suggest that it is important to analyse the relationship towards men hackers and the potential impact of a strong instrumental motivation.

Methodological considerations

Data was collected during two months in 2001 when I visited Kuala Lumpur and the UM, mainly through interviews. I interviewed twenty women students at Faculty of Computer Science and Information Technology (FSKTM). Eleven of them were undergraduates; two of them were third year students and the rest first year students. Nine were master's students who also worked as tutors. In addition, I interviewed three Heads of department, the Dean, one women lecturer and two men master's students. Five undergraduate students were interviewed in respectively two groups. This was because it was less time-consuming, but also because it might produce discussion and thus more information. All my informants found it acceptable to be interviewed in English. With a few exceptions, they spoke English quite fluently.

I got in touch with interviewees through one of the Heads who introduced me to one of the master's students who was asked to help me to meet others. Thus, I got access to a tutor's lab where master's students worked, and I could introduce myself and ask for appointments. Using so-called snowball sampling, I got in touch with more potential informants through other students. Generally, people were willing to be interviewed. The interviews took place in different locations on the campus.

The interviews have been transcribed and analysed according to the main tenets of grounded theory (Corbin and Strauss 1990), emphasising the methods of constant comparison across the empirical data (Glaser and Strauss 1968). In the analysis, I have made efforts to provide illustrative quotes from the interviews, preferably also to show the dialogue that took place between me and my informants. In order to let readers make their own interpretations, the dialogue has been reproduced close to the original transcriptions, which means that I have not corrected linguistic mistakes.

The women students I interviewed were of different ethnic origins. Eight were Chinese Malaysian, three were Indian Malaysian and the rest, including faculty and the two men students were Malay. Ethnicity is indicated by names. Indian students have names that begin with an 'I'. Some of the Chinese Malaysian students had English names, others Chinese. The *bumiputera*-quota, which constituted about 60% of study places and positions, may have been instrumental in achieving the high number of Malay women.

I cannot claim that my informants are representative of the student population in computer science and engineering. Still, they formed a diverse group in terms of age, year of study, and ethnic and social background. Since my research questions are analytical-explorative, the set of informants should be adequate. Even if ethnic aspects play an important role in a wider discussion of women students in Malaysia, not least because of the *bumiputera*-politics (see e.g. Luke 2002), it is not analysed in particular in this paper.

The analysis focuses on what the informants say about themselves and how they account for their choice of computer science, in line with the tenets of micro-sociological, interactionist approaches (Musolf 2003). It is not an inquiry into aspects of the wider Malaysian culture. Consequently, context will be invoked only when the informants themselves draw upon context as part of their accounts. Information about context was mainly presented through stories about personal experiences and background. To preserve insights related to this, the

paper presents selected informants one by one, rather than by crosscutting informants' accounts. The selection has been made to provide a diversity of voices in relation to the research questions.

Becoming students of computer science

In my interviews, I was struck by the fact that most interviewees did not consider their choice of computer science as special and as something that women in general would not consider. Rather, they saw their choice as consistent with their perceptions of femininity as well as sensible and potentially interesting. Also, the women offered quite varied narratives about their decisions. Two aspects emerged as particularly interesting and important: enthusiasm and instrumentalism concerning computing and computer science. In order to understand the variations in the gender-computer science relationship we need to explore in detail how these women reasoned around their choice of computer science. What was the role of enthusiasm relative to instrumentalism, and how did my informants account for these motives?

Enthusiasm

Most of the research that has investigated enthusiasm towards technology has looked at men and the way they find pleasure in tinkering with technology, including computers (Hacker 1989, 1990, Kleif and Faulkner 2002, Mellström 1995, 2003, Turkle 1984). When previous research has noted computer enthusiasm among girls or women, this enthusiasm has been linked to communication or graphical design and information retrieval (Håpnes and Rasmussen 2003, Kennedy 1999, Plant 1996, 2000). However, women's enthusiasm for computers has also been shown to emerge from technological aspects, including a fascination for programming (Berg 2000, Corneliussen 2002, Nordli 2003). Margolis and Fisher (2002) found that enjoyment of computing was the factor most frequently mentioned among women students as their reason to major in computer science. However, this interest went beyond technical aspects. It was made meaningful only by invoking human and social contexts (ibid: 52). Thus, we have three different ideas of where women would find

enthusiasm for computers; in human communication, technical aspects, or social utility. Were my Malaysian informants enthusiastic about computers, and in case, for what reasons?

Quite a few of my Malaysian informants were clearly interested in computers. Some of them had actually developed a profound interest and decided to study computer science as early as in primary school, like Salina:

> V: So, why did you choose to study computer science?
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> Salina: Maybe because I'm very interested, actually since I was in form 1[1]. I used to sit and tell my mum: 'I am going to be a system analyst or I'm going to be someone who is an expert in computers'.
>
> V: What interests you about it?
>
> Salina: Maybe because computer did something ... it's a machine and then ...we have to operate that ... I don't know ... I just like it very much!! (laughing)

Salina was very enthusiastic about computers and was already fascinated in primary school. She was introduced to computers through a course that was a very positive experience. Here, she was particularly interested in programming:

> Then, I was told by my computer teacher how to do a basic program. Basic programming language. Actually I am very familiar with programming language since I was in standard 4 or standard 3. Basic programming. Then I used to draw circle, doing programming and then the result is there. "Oh, I draw a circle!' (Laughing and clapping). I think from that moment I started to like computers very much. And the teacher said: Oh, that is good! And that's when I started to like computer very much (laughing)

Salina also described the general atmosphere among the other pupils as very positive toward computer science. She had no notion of computer science as a boy-thing. In her class of 50:50 boys and girls, everybody enjoyed computing. Also, it seemed that her woman teacher was perceived as a role model and made her associate computer science with her generous and careful guidance. This inspired Salina to want to become a computer science teacher.

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[1] Standard 1-6 is primary school, form 1 to form 5 is secondary and higher secondary school.

There were also informants who had been fascinated about computers because it was a machine that could be programmed to do things, beyond imagination, as in the case of Haifa, who since she was twelve had wanted to make a robot who could do all kind of things, including housework for her:

> Haifa: (...) I wanted to do a machine that can do any job...at that time I was twelve years old. I don't know name of that machine, now I know, that machine is called robot. So, I'm very interested to think about how to make life easier. So that, people can rest, people can take care of family, people can have leisure, people can go anywhere, people can travel...with robot. We have a harsh life, we has so much to do, like cooking, like doing everything. If we have a robot to sweep the floor, we have robot to do everything in home. I always think about that. I look at my mother when I'm studying, and my mother asked me: sweep the floor, sweep the floor. And I said ah!! can somebody sweep the floor?

Haifa had completed a bachelor degree four years ago. Now she was married and had three children, and wanted to pursue a master in artificial intelligence.

Yin Sung was another enthusiastic computer student doing her master's degree. She had also been introduced to computers as a child.

> Yin Sung: I wanted to join this computer science because mostly because of my dad, I went Pittsburgh for two years. (...) My dad was doing his master's there. It was very near Carnegie Mellon, the top computer school in the world. So I was really... my mom took courses there, so I was very aspired to become a computer scientists. I was very young at the time, around 7 or 8 only. But I remember it very well.
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> V: And since then you have wanted to be a computer scientist?
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> Yin Sung: Yeah. Very interesting.
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> V: What did you find interesting about it?
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> Yin Sung: I think that when you are small, you tend to get: 'wow, this can do a lot of things!' So then, when you develop you can see that it helps a lot of people with banking and a lot of things. So many things ... There is a lot of areas that can be widened ... and then it's the advancement, the level, so you can think that you may make a change in the whole system. So, it will be great to be going into computers.

The interest in computers was quite often combined with an enthusiasm for studying computer science because of what was perceived as brilliant prospects. Maimunah demonstrated that clearly.

She was a first year student, only eighteen years old and very happy to be admitted into the computer science programme. This programme had been her first choice and the rest of her four choices had been computer science at other universities. Maimunah was very enthusiastic and said she had wanted to study this topic ever since she was in secondary school:

> Yes, because I have always thought that computers were something very, very great! I usually have problems with my own computer, and I always think: I *should* learn about computers! I should know better! (laughter) Yeah, it's like ... it's no point ... okay, I'm a person who like to know computers, I like surfing, I like chatting, I like to find new articles. So, when my computer crashes and something, I get very angry and think: *Why* can't I solve this problem? Why can't I work it out? So that's why I really, really want to learn about computers.

Maimunah also considered computer science to be a field with good job prospects:

> I think this is very good subject, a very wide range. After I finished this course, I make sure that I can get something. I mean, it's something for me to ... it's a job for me...

Also, later in the interview it turned out that her parents had encouraged her to choose computer science.

Unlike many others, Noriah's father had not encouraged her to study computer science but chemical engineering. However, Noriah did not want that, saying she was not very good at chemistry. Since her father wanted her to study engineering, she chose computer science, which was a "new thing' that not many knew much about. She figured it would be useful.

> Noriah: The most technological is computer science. So I took that one.
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> V: Because you wanted to take the most technological?
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> Noriah: Yes, I am used to the ... my father is an engineer. So I get used to the technical thing. And then it's unique and quite new, so I take that. So I started study, and it was quite good course really, so I continue with my degree. Actually I want to take the computer engineering. Computer network engineering is the same thing like computer science, but it's nearer to computer engineering. So when I don't get that course, I only get the computer science.

She had never used a computer before she started, but she took some part time classes in computing during her summer holidays before she entered the programme. She had chosen to major in software engineering, which she was very enthusiastic about:

> Noriah: Because...actually my father like anything that is related to engineering (laughing).(...) So during my diploma and my degree, I did computer science. (...) So when applying for my master's I saw this application form, and it was engineering!! (laughing) What they offer here is software engineering! (laughing) So it's okay! It had the word "engineering' in it, so I could tell my father that I took engineering, even though I don't like chemical engineering (laughing)
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> V: So, is it important what your father thinks?
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> Noriah: Basically he influences me, but actually is not; the technical is not all because of him... Yeah ... because we can make our own decision, like that, so ... yes, basically he influences me! (laughing) But I love this course, after I enter this, I love this course! Because, software engineering actually involve the process of software development.

These women shared an enthusiasm for computers and computer science; some had even developed this interest quite early. However, contrary to the cyberfeminist assumption, the enthusiasm was not related to communication and networks. It was mainly related to the understanding of computers and the ability to manage them, even if the capability of communication or graphical design was mentioned as well. It was also interesting to note how most of these women combined enthusiasm with accounts that emphasised how computer science was a sensible choice in terms of future careers and how they took advice from parents and other family very seriously. In a way, they got the best of both sides. What they wanted to do, was also the sensible thing to do and what their parents advised them to choose. Computer science did not represent any break with paternalism, perhaps rather the opposite.

Instrumentality

Many of my informants had chosen computer science mainly for instrumental reasons and were not particularly interested in computer science as such. That meant they did not have any interest in computer science in the first place, but still made it their first choice, mainly because of good job prospects and career opportunities. Many had also been strongly encouraged by their parents to study computer science, like Indrani, who was in her third and final year in the bachelor programme. She originally wanted to become a veterinarian, but her father had talked her out of it and suggested computer science instead:

> Indrani: Actually, when I wanted to come into university, I wanted to study veterinary science (...) But then my father was a bit against it, because he said it is difficult for girls to go in that line in Malaysia. So I had to agree with him. Because they tend to send you to Sabah or Sarawak where it's hard for me to survive. (...) Sometimes they go to all these isolated places, and it's difficult for me, because I grew up in the city. (...) So actually my father suggested for me to do IT or computer science. I was a bit interested in computers also. (...)
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> V: What was your father's argument for you to study computer science?
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> Indrani: He said that there is a lot of job opportunities coming up. (...) He told me: you can have your master's and Ph.D.s and you can earn enough money for your master's and Ph.D.s. I said like: All right. I am glad he told me.

It is obvious that Indrani paid quite a lot of attention to her father's advice. She said she wanted to value his wishes out of respect for him and what he had done for her. The norm about following parents' suggestions or request about educational choice was widespread. Ah Ling started to study computer science because she 'obeyed' her father, as she said in a humoristic tone:

> Hmm ... it's a long story (laughter). Like, I told you, right, that I like sociology. I like psychology. Actually, these were my first choices for my undergrad. But because my dad, he is a teacher and he is quite realistic, so he says that if I ... Like, in Malaysia it is not very applicable if I study psychology. He means, cannot gain more money, but this is not true in UK and other countries, it only applies for Malaysia. So, why my dad says: cannot!! So I just 'obey' my dad and take computer science. But that is, at that time, a very famous course. And my brother is also in IT line. So, I think he could help me. So I just ... take it.

Wanda had just started and told me that:

> Actually, computer science is not **my** main interest, It's my dad's main interest, you see (laughing). Actually, because, I was very, very interested in chemical engineering. But then I was having some skin problems, so my dad kind of talked me out of it, because of allergies,

maybe chemical reactions ... So, then during my break, my STPM, before I enter university I will sit for the paper, between STPM and this intake, I taught at a kindergarten, I then I had really fun there, and then suddenly I just decided to take child psychology. Then again, my dad was like: No you can't take that, because overall in Malaysia it is true that the market it is not good enough for child psychology (...). So, my dad kind of ... should I say 'brainwashed', talked me into it, saying that this is computer era, whatever ... So, okay, since it is a new thing, why not give it a try? That is my concept toward taking computer science actually.

Wanda wanted most of all to study petroleum engineering, because she liked chemistry a lot and because chemical engineering was 'one of the hottest choices' as she put it.

At this point we may ask how come the parents of these women were so eager to encourage their daughters to study computer science? One obvious suggestion is the fact that the Malaysian government had been urging people to study IT, particularly during the 1990s. Also, the profound priority given to conspicuous IT-project in Malaysia, like the Multi-media Super Corridor (MSC), was probably an important backdrop of these parents' perceptions of where the job opportunities would be in the future. This was suggested in the interview with Supryia. When asked about why she started, she said:

> It is because of my father's advice. Because during that time period it was, that was in early in 1990s... if I am not mistaken that was in 1993, when the government start to urge Malaysian people to study IT. And that's what made my father advised me to do so, choose this field, especially IT. So I just follow this advice, and I am quite satisfied in this field. I want to be a professional in computing, on IT and computer related fields.

Another master's student, Sadaah, who had studied marketing in the US, decided to change to computer science because 'Malaysia is now turning to technology and computing'. Also, she found that too many Malaysian at her US university studied marketing. She wanted to change to IT to make herself more competitive.

Even if most of the women students I spoke to had been encouraged by their parents, particularly their fathers, there were exceptions. Rafiah, a master's student came from a small village in the provinces and grew up as the oldest child in a family where no one

had higher education and where her family did not acknowledge t value of having an education very much. Also, they did not suppc her decision to take a master's degree.

> [My parents] don't like schooling and start small business. And enjoy things like that. So if I tell my problems to them, it's difficult for them to understand. They say: 'you chose it. You are the one. No need to do master'. They don't encourage me to do master. ... 'Bachelor Degrees is very good enough to get work. No need to study. Later you will get married'. And something like that. You see, I want to do my master for my future as well, and have an academic life, which is good for me as a woman. Because later on, in an academic life I can concentrate on my career and my family as well.

Rafiah was quite troubled at the time I interviewed her. She felt pressure from her family to finish her master's so she could start t work and earn money to help with their financial problems. Rafial wanted to break away from the kind of life her parents live and finc better opportunities through an education and a career. She said she wanted to become something different than her peers in the village she came from and for her younger siblings to do that as well.

The obligation and pressure to provide for younger siblings o older retired parents was a recurrent theme among other women students, even if no one else was yet in Rafiah's situation. It was a consideration that entered their plans for their future. Even first year students thought about this:

> V: Have any of you thought about doing a master?
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> Sheryl: I think about it, but it depends (...) on my family condition. I have to ... because have a brother, he is doing engineering course at the other university, cause there is only two of us in our family. And then my parents are already old, if ...after three years – because my brother have to study four year in the engineering course- so after three years, if I graduate, I don't work, so *how* should I afford my family, my parents.
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> V: Because you have to take care of them because they are old?
>
> Sheryl: Yeah.
>
> V: What about you?
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> Mei Wee: Mostly the same thing as hers. Cause I'm the oldest, and my father is retiring soon, so after that there will be no income for my

family. So, when I graduate, I still have to support my brother, he is quite young.

Even if many of the women had been persuaded or encouraged by their parents to study computer science, most of them found computer science to be an interesting subject. They also acknowledged that the choice to study computer science was sensible and wise, due to the good job prospects. However, often the women admitted that with complete freedom, they would have selected something else:

> V: If you could choose? If you could have a dream job?
>
> Sheryl: Hmm...dream job. It would be very different from what I am studying now (laughing) Because before you apply for the science course, actually I was very much interested in engineering, but because of my result, and then we are Chinese, there is very much competition among the Chinese, because for the Malay is different, so because of the result I cannot choose engineering.
>
> (...)
>
> V: Okay, and you (to Mei Wee)?
>
> Mei Wee: I'm more interested in music. (...) I like playing the piano, things like that. I would love to study music, but then...it's not ... realistic. Because ... you know, maybe work as a piano teacher or performing, but it's not ... how do you say it. It's not a safe job.
>
> Sheryl: Parents always object. (laughter) If you want to learn art or music.

An even more severe conflict of interest was evident from the interview with Azizah, a first year student. She had wanted to study medicine and was not at all happy to be in the computer science programme. She was the youngest and the only daughter in her family. Her mother, who had recently died, had wanted her to become a doctor. Since she was not admitted to medicine, her father and brothers had persuaded her to study computer science instead.

> Actually I'm not so into this computer science course. My target is to enter medicine, but then my exam was not that good, and computer science is my fourth choice after medicine. And I was hoping that I could get into medicine, but I ended up here in computer science. I was a bit upset, but then, I try to accept. It's my fate, right? And then my father and brother said that computer science is good, and it has a prospect and you'll have a good job after you graduate and if you don't

like it, at least you can be a lecturer, right? So, I'm trying to ... to like it, even though, even if I'm *not* really, really into computer. I'm *really, really* into medicine, actually. So I'm a bit disappointed, because I cannot get into medicine.

During the interview, it became clear that Azizah was quite indignant about being persuaded to do computer science, and that she was admitted to computer science instead of medicine, when she had prepared to study medicine for two years.

> I'm not interested in computers, not *really* interested. And you know, when you don't like to do and you are forced to do and...(searching for words) it's quite *hard* for you to accept, right? And when you are pushing to hard to accept it and it...it's so hard for me to learn about everything, and I'm pushing myself to hard to...what I've been taught. So it's hard for me (...) And my mother encouraged me do medicine since I was in kindergarten. I wanted to be a doctor. And then after my mum passed away, then...my dad say, well you should go for computer science, since your mum is gone, right? And you should do computer and I say, okay, it's my father's wish, lah! I go for computer science.

It is obvious that Azizah find it important to follow her father's wish. However, the strategy she considered to achieve her goal was to take a computer science degree first and then study medicine.

Clearly, it is not easy to go against the family's will in the choice of education. The norm that you should follow your family's/parent's/father's wish was strong. However, the interview also demonstrated Azizah's anger of being put in this situation and also her agency, her strategies to get out of this conflict of interest between herself and her family. She was really determined to study medicine. It is interesting to note that the friend of Azizah, whom I interviewed together with her, Maimunah, made a prudent attempt in that interview to provide an individualistic voice. When Azizah said that she wanted to satisfy her family, Maimunah stated that 'I want to satisfy myself!'.

When Maimunah and Azizah discussed their future prospects, a lot of different options were mentioned. Maimunah had a dream about having her own company. Also, she had thought about going abroad to pursue a master's or a PhD. Also, working in the MSC or in companies was mentioned as well as opening a CC, a Cyber Café:

Maimunah: Yeah ... but I'm not really into business? I still prefer to be a lecturer (little laughter). Yeah, cause I really don't like to handle things on my own. If you have a company, you are the big boss, you have to know what is going on. But if you are a lecturer, you just go to your faculty and you teach, and you know what is going on.

Azizah: But if you have your own company, then you can earn more money. More money, more money, more money! More money and more challenging.

Maimunah: But I think...Because if you have your own company, you have to sacrifice your time, your energy. And let's say you are married and have your kids, if you have our own company, you be like, so devoted in your job and, you know, your husband and kids will be left like that...

Azizah: You spare time with your family.

Maimunah: Yeah, like my dad, he is a lecturer, he has spent a lot of time with us. It's better that way. And you know, I'm a female so...(laughter), I think will just be a lecturer...

In the way they discuss and talk about their future jobs, they seemingly exercise quite a lot of freedom and put forward many different opportunities. Also, Maimunah mention her dad as a parent who spends time with his children as a role model. Maimunah's remark about being female indicates that when including family plans, being a lecturer was considered as a suitable job particularly for women.

Perceptions of gender and computer science

The Malaysian women account for their choice of computer science in terms of enthusiasm for computers or by reference to instrumental aspects, like good career prospects. Also, parental guidance or persuasion and the women's concern for their families play an important role. In fact, the appreciation of computer science as a sensible field of study in terms of safe and good future income seems to be formed by a complex set of concerns related to the way these women consider obligation towards, and acknowledgement of, their families' wishes as well as their own yearning for individual needs and preferences.

Research about women computer science students in other institutions has also identified instrumentality related to future career possibilities as very important in the choice of a computer science education (e.g., Lagesen 2004, Margolis and Fisher 2002). However, parental arguments or guidance are less prominent or at least less explicit in these accounts of why they study computer science. Another striking difference is the absence of gender as an accounting resource in their narratives. The construction of gender and computer science as an amalgam of masculinity and technology that is so prevalent in similar studies in Western countries (see, e.g. Wajcman 2004) seems to be absent. In this way, the gendering of computer science is different from the assumptions underlying Wajcman's technofeminism. Men's power seems mainly to be mediated through the family. So how was computer science gendered among my informants?

To begin with, computer science was not at all deemed masculine by my informants. Rather, it was described as different from areas that were considered masculine, like engineering. Upon question, Dr. Mazliza, a young Head of Department said:

Dr. Mazliza: I never thought of computer science as a masculine subject.

V: Why not?

Dr. Mazliza: It just never seemed that way. You know, engineering is something that people see as masculine, or geology. But not computer science. I don't see what is masculine about computer science?

Engineering was seen as the archetypical masculine field, particularly civil engineering. When computer science frequently was compared to engineering, it was to explain why it was not masculine. Azizah and Maimunah do this in an interesting way, as it also provides an account of the underlying considerations when a profession is characterised as masculine or feminine:

Maimunah: You can say that computer science ... this computer science course is meant to be for women instead of guys. I mean, guys usually go for engineering, architecture, contractors, that kind of jobs.

V: Why?

Azizah: Out. Because it is out, not in the office, they're doing outside.

Maimunah: They get exposed a lot.

Azizah: Exposed, yeah. More dangerous.

Maimunah: Except for us, for girls, they expect us to stay in the office, to do that kind of work.

It seemed that the basis to argue engineering as masculine was the way that it was embedded in outdoor work, where you would be exposed to the sun and perhaps to men workers. Computer science, on the other hand, could be considered feminine because it was associated with office work, which meant working indoors, perhaps mostly with women. Sadaah, a master student, formulated it like this:

But in Malaysia there are many in IT science, many women also enter them now. They just like it! Yes. To do technology, right? They want to do more. And if we work with computers, we don't have to go out, right? We can just sit there in the office.

The idea that it was most suitable for women to work indoors may be interpreted in several ways. Security was deemed an important issue, as indicated above. Also, gender discrimination in male-dominated environments was perceived as a potential barrier:

V: What do you consider to be the typical female subject here?

Mei Wee: Hmm...I think office work. Business...computer science... doctors...dentist. Actually there are quite a lot of jobs for women. I think engineering is still a male dominated area. There are few females in engineering.

V: Why do you think it is like that?

Mei Wee: Maybe...for engineering, where you have to build buildings right? And engineers are required to go to the site to check for the building constructions, stuff like that. (...) because they have to converse with the labourers. And I heard from my friends, they say that, labourers don't really respect women. So, it's better for men to go down to talk to the labourers.

V: (To Sheryl) You thought about studying engineering. Did you think of it as a masculine subject?

Sheryl: Yes, but I think it is more to the civil engineering. For chemical engineering is more to the female side. Because for chemical engineering, most of the time you work in labs, testing the stuff like that. So I think it's quite suitable for females also. But for civil engineering, I never thought about that. Because, like she said, we have to go to the site

and check out the constructions. Because, I don't like sunlight (laughter). So, you see, I won't choose civil engineering.

Thus, not all types of engineering were seen as masculine. Apart from medicine, chemical engineering was mentioned by many as the most popular choice for women. The perception of civil engineering as a clearly masculine field seemed widespread (see Mellström for a similar example 2003: 48-49).

There were also areas within computer science that were perceived as more or less masculine or feminine. Computer networking and 'hardware' were the parts of computer science that were considered masculine and contrasted to, for instance, software engineering and information systems which were seen as particularly suitable for women.

V: So, did any of you think of computer science to be predominantly male's subject?

Sheryl: Not really, I think it is quite equal.

Mei Wee: But maybe on the hardware side it is more males than females, because they have to carry the computer around, with wires and stuff.

Sheryl: Like network, we have to learn about circuits, electronic circuits; I don't like electronics (laughter).

V: Is that more of a male subject, you think?

All: Yeah!

V: If this is more of the male part of computer science, do you think there are any parts that are more suitable for females?

Sheryl: I think software engineering and Management Information Systems (MIS) is maybe more suitable for females. Because, software engineering is more to the programming side. Proceeding what the program inside the computer work for, learn more about programming and not so much about physical stuff, you know, the electronic circuits (everyone laughing).

This way of reasoning in relation to gender and computer science was quite common among my informants. Soo Chin, one of the master's students maintained that:

(...) a lot of boys like networking, but girls like more of theory-things. So a lot of girls are going to MIS, Management Information Systems. More on the theory side. But networking is more technical.

Sheryl, a first year bachelor's student put it in a similar way:

> Hmm...Among all the four majors, I think software is the best choice. Because networking is...I think most the people are guys, cause it involves physics, electronics ...

Networking required moving a lot around, to customers and clients to set up networks, and thus involved a security issue as well. Also, it was seen as a masculine field because it was dominated by men. This was also in fact a reason for some of the women to choose networking. Fatimah had chosen this speciality because it was male-dominated and she wanted to compete with men, and because it included less reading which she did not like:

> So, MIS is dominated by ladies. So, I just feel like I want to make competition with men. In fact, I think it is interesting, because in MIS you have to do a lot of reading, it's similar to IT. The subjects are approximately the same, lah. Management, statistics...I don't like to do readings, that kind of studying. So, that's why I chose networking.

Also Maimunah was attracted to networking of this reason:

> I think I'm impressed by that, because I can see a woman. Because usually I see, like a few friends, and my cousin, and they are all guys. The ones that have done networking, they are all guys. I want to be the first woman in the family, the first ...

The woman Maimunah refer to was Dr. Mazliza, Head of the Networking Department and also very young. When I mentioned to Fatimah that Dr. Mazliza was my contact person, she was very impressed and expressed an admiration toward her:

> Oohh ... (surprised and impressed). She is very eligible. I had class with her last year, and she is very ....I would like to be like her!!

Clearly Dr. Mazliza, and also the other Heads and the Dean, provided a variety of role models for the women students, which may explain why so many of them wanted to become lecturers in computer science. In fact, nearly all the women I interviewed wanted to pursue an academic career and become lecturers at the university. They mentioned several reasons. A flexible job situation was attractive to many. Some of them, like Ah Ling, had experience from working as a software engineer in an ICT company:

> Okay ... As I told you before, I was a software engineer. We started work at seven o'clock and we came back from work normally at seven or eight p.m. So, one can say that the whole day is sold to a company. So, that kind of life is not the life that I want. Okay, that's why I came back to school to do my master course, is to make me become a maybe lecturer at university or colleges. So that's the way to make me have more time, flexi-time to take care of me and my future family. So, the choice is a career path that allows me to have more time to my family.

Sadaah, who was the only one with her own family, had also been working in the industry but wanted to become a lecturer:

> Sadaah: After I married, before that I like to travel, so after I married, I don't want that, I just want to relax. So, we have a family right, so I don't want to rush anymore (laughing a little)
>
> V: But you still want to work?
>
> Sadaah: Yes, I still want to work. I just want to be a lecturer. So, my husband also says that, better you be a lecturer so you can take care of your family right? You don't have to travel...lecturer also travel, but not so much right, so you have to take care of your family, because men always busy right? And then it is nobody to take care of my son. So, I want to be a lecturer.'

Sadaah's argument also implies that limited travelling and exposure (compared with working in the industry) were important reasons to pursue an academic career. Salina emphasised that working in the industry involved more gendered barriers than in academia:

> V: Do you think there are any barriers for you as a woman in your future work situation?
>
> Salina: Hm...As a lecturer, there are no barriers I think. But for industrial company or big company, maybe ...one barrier is that women always can't stay in back the office for a very long time, maybe not after ten o'clock, eleven at night, then they have to go back home. Security is important.

Also, some informants talked about how they enjoyed teaching in itself as a motivation. Teaching has also been a traditional women's position in Malaysia and deemed appropriate to women (Ong 1996). Only one, Yin Sung, wanted to work in academia because she wanted to do research, while some said they enjoyed both.

My informants did not offer spontaneous comments on the relationship between gender and computer science, but when I asked

them, they definitely provided a gendered account of the discipline. However, the accounts were dissimilar compared to those that dominate Western research literature. First, computer science was constructed as a discipline well suited for women, not as a masculine recluse. Second, the way gender was invoked in a different way. Physical activities like working with electronics and mechanical objects were looked upon as masculine, in contrast to software engineering and programming, which were deemed as 'theoretical' and thus fitting for women. The gendered dichotomy of physical and theoretical was quite prevalent in my interviews. Women supposedly liked theory while men preferred (and were better at) technical and practical tasks related to the computer.

Many women students lacked previous experience or knowledge of computing when they entered the programme. Interestingly, compared to Western research (e.g. Margolis and Fisher 2002), very few complained about this. Usually they said that it was just a matter of working hard, and then they would catch up:

> Ah Ling: Before, I had no computer science knowledge, before I entered the first year degree. And the first time, I remember, when I went to the class, the diskette right, I hold it (the wrong way), (laughter) all my course mates was laughing!!
>
> V: You had no previous experience with computers?
>
> Ah Ling: Yes, so I told myself; just study hard, study smart, to catch up. So, now I have.
>
> V: Did you think of it as a handicap?
>
> Ah Ling: No ... I keep my self very motivated, very hard working. I put in a lot of effort so I catch up. So, after a few months it was not a problem.

Hard (and smart) work was her and many other women's preferred strategy to cope with lack of knowledge and experience in computing. Moreover, there was a widespread belief that women worked harder than men. Soo Chin put it like this:

> Like female students ... Yes, they are more hard working. I think they study more than the male students. I mean their study time. Because the male students, they like to do things like ... I mean, they like to play! I think female students are more hard working, I mean they like to open

their books, and during exam time they study. Yes they are more hard working than male students.

Also, the idea that Chinese and Indian students worked harder tha Malays was present, but probably this applied first and foremost men students. A few of the women I spoke with, mainly bachelor students, mentioned that they saw gender differences in how men an women coped with programming.

> Indrani: The other girls ... basically, most of the girls don't like programming. Even my friends, when we talk together, we don't like programming, because it is a bit hard for us to understand. And we don't know how guys can understand it better. So ... but I think, if we just keep on studying it, we tend to understand. I just have to go through it more times. Then I understand.

Fatimah had a similar experience. However, according to her, wome had something to trade:

> Hm..yes...male students, I think they like programming very much. During my first year, I'm not used to programming, then I don't have my PC, so I don't do a lot of practicing. But the males...they even if they don't have their own PC, they come to labs and practice, and they are good at programming. This is a big difference, definitive. Hmm ... but female students is more ... how to say ... they are more responsible, they/we always attend classes and take notes and the males will ask the notes from us. So ...

Like in other studies of computer science students (see e.g. Berg 2000 women students tended to use men as a resource:

> Indrani: But I tend to look at the other guy, and I always go and ask him for help, because he is good in this programming and all that (...) before he started studying here, he already was doing Cobol. He had basics in computers. So, well, if I have any problem I go to him. So if I have any problem in programming or anything, I have seniors here. One guy was doing master's. I used to go and see him, and he used to help me a lot. Always willing to help, that's a good thing about them.

Still, the domination and perceived superior competence of men wa: not perceived as a real problem, and definitively not by the master': students who did not mention such experiences. For the bachelor': students, it became even more important for to study hard anc consequently substantially increased the chances of performing ver}

well. This is a rather different situation than those described by cyberfeminism or technofeminism.

A different computer science?

We probably need to conclude from the study at UM that Malaysia is not a cyberfeminist utopia. There were many women in computer science, but they did not excel in communication nor did they find their situation unambiguously liberating. Rather, we learn that there are high demands in terms of efforts. Here, the observations resonate with Ong's (1995) and Harris' (2004) arguments about the different, difficult and contradictory expectations toward young women. My informants told me that they are subjected to numerous demands. Many of the women felt a pressure to sustain their family's finances and to provide for elderly parents as well as younger siblings. Also, the expectation to be an obedient daughter was evident, the costs of which were well illustrated by Aziza's situation. The expecations also included getting married and having children. Most of my informants said they wanted that, but also that they wanted to combine a family with a career. Being a successful career woman was also important. In these young women's narratives, there is a mix of individualised and, in a western sense, 'modern' discourses (see Ong 1999 for a critical discussion) about opportunities and aspirations, as well as more 'traditional' family-bound concerns, like providing for parents and siblings and being respectful daughters.

Further, we observe a co-construction of gender and computer science that is different and appears as more complex and less stereotypical than what is implicated by the main body of western research. The most prominent difference is that my informants do not see computer science as a masculine discipline. Rather, there is a complex coding of gender in relation to computer science that is mediated by what is perceived as being 'suitable' for women. This reflects an understanding of gender where women are associated with being indoors, with being protected, and with the office as a kind of woman-friendly place, compared to what are male-associated spaces like construction sites and factories.

Considering the level of enthusiasm among my informants toward a wide range of aspects of computer science, there is little support fo the cyberfeminist thesis that women's preferences are mainly directec toward communication. For example, the women I interviewed were not particularly enthusiastic about the communicative aspects o: computer science or other 'soft' features of the discipline. Theii fascination included, to a large extent, what many westerners perceive as 'masculine' areas of computer science like software engineering, programming and hardware. Also, their positive attitude is related to the above-mentioned spatial aspects of office work.

There is not much support for Wajcman's (2004) technofeminist programme either. The high proportion of women among Malaysian computer science students is not a result of feminist politics. Yet, there is a national policy that seems to have influenced the recruitment of women to computer science, encouraging all young people to study IT. Further, practically all the women I interviewed emphasised that their motivation to study computer science was linked to their goal of getting a well-paid and secure job. However, from Wajcman's perspective, it may be appreciated that the larger number of women in computer science seems to make the culture more welcoming to women.

The attractiveness of computer science was also linked to the fact that parental instruction to study computer science was taken seriously. I interpret this as a sign of respect and acknowledgement as well as obligation and moral duty. These prospects of a safe job with a good income were also central in many of these young women's efforts to become economically independent, preferably before marriage. This may be a particular concern for Malay women who after the Islamic resurgence have been subjected to less freedom in family matters and marriage (Nagata 1996, Lie and Lund 1994, Luke 2004).

From a technofeminist perspective, it is important to emphasise how the gendering of computer science was particular. The most striking is the lack of masculine references. This observation is supported by the phenomenon of parental guidance. If computer science was perceived as gender-inauthentic to women, parents probably would not so strongly suggest this sort of education to their

daughters. The absence of a hacker or computer geek mythology in the accounts of my informants is also striking and worthy of notice. However, there is a fairly widespread idea that men students know more about or have a greater aptitude for programming than women students. This could have produced an effect similar to what the hacker mythology can, e.g. act as an exclusionary force against women. When this is not the case, it owes a lot to their shared understanding that hard work helps. Similar to the observation of Margolis and Fisher (2002), we see how the women's willingness to invest hard work and, above all, their belief in the potential of hard work to solve problems, counteracts mythological ideas. 'Hard work' functions as a moderator that stifled any development of a masculine hacker ideology that would define women as outsiders.

From a theoretical perspective, the main lesson to be learnt is that co-constructions of gender and computer science are more diverse than commonly believed. While the main western finding that computer science is culturally coded as masculine has proved to be highly resistant to efforts of change, this is not the only possibility. In fact, women computer science students in western institutions may also protest or counter the masculine coding of their discipline (Berg 2000, Lagesen 2004). However, in this paper, I have above all tried to show how my informants co-construct gender and computer science in a complex way, which – compared to Western research - allows greater diversity in the gender and computer science relationship.

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