Why are There so Few Female Computer Scientists?

Abstract

Women pursue education and careers in computer science far less frequently than men do. In 1990, only 13% of PhDs in computer science went to women, and only 7.8% of computer science professors were female. Additionally, the percentage of female computer science students appears to be increasing at only a slow rate or even decreasing. Apart from ethical concerns at women's lack of participation in computer science, the demographics of the country are such that the United States will not have enough engineers and scientists unless underrepresented groups increase their participation. This report examines the influences against a woman's pursuing a career in a technical field, particularly computer science. Such factors include the different ways in which boys and girls are raised, the stereotypes of female engineers, subtle biases that females face, problems resulting from working in predominantly male environments, and sexual biases in language. Finally, I discuss effective and ineffective ways to encourage women. A theme of the report is that women's underrepresentation is not primarily due to direct discrimination but to subconscious behavior that tends to perpetuate the status quo.

This report is expected to become an MIT Artificial Intelligence Laboratory Technical Report.

Introduction

Only a small percentage of computer scientists and computer professionals are female. In the most recent years for which statistics are available, women received a third of the bachelor's degrees in computer science, 27% of master's degrees, and 13% of PhDs. Not only do women make up just 7.8% of computer science and computer engineering faculties, only 2.7% of tenured professors are female [Frenkel 1990, page 38] [Gries et al 1991]. Even worse, these numbers seem to be improving only very slowly or even dropping [Leveson 1989, page 3]. Many girls are still steered away from math and science or choose not to pursue careers in these fields. Additionally, many women who go into computer science are conscious of being treated differently from men or feel that they face additional barriers. This report describes some of these barriers.

As someone who has loved math and computers ever since I was a little girl, I have always found it strange that so few females share these interests. At the computer camp I attended, the boy-girl ratio was six to one. It was similar at high school math club and the math summer program I attended. At MIT, only about 20% of the computer science undergraduates are female, while other departments, such as biology, are at least 50% female. I researched this report to explore why females so consistently stay away from computer science, why people of both sexes seem to expect less from women, and why a woman is considered unfeminine if she is an engineer. Because math and computer programming came easily to me and to many other women who have had the opportunities, women clearly are not inherently unable to do well in them. Instead, girls and women are choosing, consciously or subconsciously, not to go into or stay in computer science. While one cannot rule out the possibility of some innate neurological or psychological differences that would make women less (or more) likely to excel in computer science, I found that the cultural biases against women's pursuing such careers are so large that, even if inherent differences exist, they would not explain the entire gap. In this paper, I describe the biases that women face in pursuing careers in computer science and how they deal with them.

Organization

My report examines the following topics, each occupying a chapter:

1. Societal pressure against women's being successful, particularly in engineering.

2. Ways in which the male-dominated environments discourage women.

3. Inequalities in language, their causes and effects.

4. Negative consequences of some attempts to help women.

5. Conclusions and recommendations.

At the end of the report are appendices which contain additional information, such as the methods I used for data collection and implications of recent research on sex-based intellectual differences. Finally, there is an annotated bibliography.

The report does not directly address the problems of racial minority group members, such as blacks and hispanics, who are also underrepresented in computer science. Readers should not interpret my lack of material on this subject as implying that no bias exists against these groups. On the contrary, I have been told by a black female computer scientist that the color barrier is greater than the sex barrier. In many parts of this report, such as Section 1.2.1 on subconscious bias, the experience of people of color is analogous to that of women.

Readers are welcome to contact the author with questions or comments. To do so, send electronic mail to ellens@ai.mit.edu or use the following address:

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Acknowledgments

Because many contributors wished to remain anonymous, I cannot thank them by name. I am pleased, however, to have this opportunity to acknowledge Prof. Sherry Turkle, who encouraged me and supervised the early stages of this project, and my friend Nate Osgood for his support and thoughtful comments. Additionally, I am grateful to Dr. Vicki Almstrum, Danielle Bernstein, Joost Bonsen, David Chaiken, Prof. Judy Goldsmith, Prof. Eric Grimson, Dana Henry, Magdalena Leuca, Prof. Barbara Liskov, Prof. Nancy Leveson, Dr. Fanya Montalvo, Philip Spertus, Prof. Lynn Stein, Becky Thomas, Christine Tsien, Dr. Kim Wallen, Janet Wixson, Liz Wolf, and Mary Ellen Zurko for their comments on earlier versions of this paper. I am also grateful to Dr. Anita Borg for managing an electronic mailing list of female computer scientists and to the women on the list who have helped and encouraged me. Finally, I want to express my appreciation of the many students, staff, and professors at MIT, particularly in Electrical Engineering and Computer Science, who have been wonderfully supportive of this work, especially EECS department head Prof. Paul Penfield, CS head Prof. Fernando Corbató, MIT ombudsperson Prof. Mary Rowe, and EECS administrator Marilyn Pierce. Part of this work was done while I was receiving financial support through a NSF graduate fellowship.

Contents

Chapter 1

Societal Factors

> *Women beware. You are on the brink of destruction: You have hitherto been engaged in crushing your waists; now you are attempting to cultivate your mind: You have been merely dancing all night in the foul air of the ball-room; now you are beginning to spend your mornings in study. You have been incessantly stimulating your emotions with concerts and operas, with French plays, and French novels; now you are exerting your understanding to learn Greek, and solve propositions in Euclid. Beware!! Science pronounces that the woman who studies is lost* — R. R. Coleman, M.D., 1889.[1]

In this chapter, I will describe various ways in which women are steered away from professional success, particularly in traditionally male fields such as engineering.[2] Girls and women are subject to societal pressure to stay away from such subjects or to accept themselves as "unfeminine". Academically successful women are generally seen as being less attractive and less happy than less highly-achieving women.[3] Additionally, there are still people who believe, consciously or subconsciously, that women are incapable of being top scientists and who take women less seriously in general.

[1] Coleman, R. "Woman's Relations to the Higher Education and Professions, as Viewed from Physiological and Other Standpoints." *Transactions*, Medical Association of Alabama (1889), page 238. Quoted in [Ehrenreich et al 1978, page 128].

[2] Readers outside of the field may be confused by my use of the term "engineer" to include computer scientists. I do this because the field of computer science does not fit neatly into either engineering or science. Despite the "science" in the name, university computer science departments are often attached to electrical engineering departments or are part of the school of engineering. Additionally, computer programmers and designers tend to think of themselves more as engineers than as scientists, although some individuals and organizations consider computer science as a branch of the mathematical sciences.

[3] Of course, the stereotype also exists of male engineers being less attractive than other males. See, for example, [Wolpert et al 1988, page 2], [Turkle 1984, Chapter 6], and [Holland 1990, pages 164–165].

1.1 Stereotyping

1.1.1 Background

Currently, most people in positions of power and respect are male. Men are rhetorically asked in [Sandler 1986, page 3]:

> Imagine that your lawyer, your doctor, your priest, rabbi, or minister, your Senator and Representative, your mayor, the president of your institution, most of its trustees, almost all of the deans and most of your colleagues were all women. How would you feel?

Not only are these positions held by men, but the media propagate stereotypes of women. A recent study found that "women are often still depicted on television as half-clad and half-witted, and needing to be rescued by quick-thinking, fully clothed men" [Adelson 1990]. Whether or not people realize it, many of their expectations of men and women are based on what they have observed and by what messages their culture presents. As one Usenet[4] reader wrote:

> This group [comp.society] has been discussing various stereotypes for a long time now. The problem is that we haven't acknowledged the importance of stereotypes to human cognition. We could easily call stereotypes heuristics. A heuristic is a device that allows a processor to use some sort of knowledge to reduce a search. In very rough terms, stereotypes allow the wetware in our heads to do less search when looking for evaluations of people and behaviors to events.
>
> The human brain is the best known implementation of these heuristics. In fact the human brain is so reliant upon heuristics, that when presented information that contradicts such a heuristic we feel confusion and discomfort.
>
> So where is all this going? For better or worse, humans will continue to make stereotypes based on input from their environment. Since the average person rarely meets programmers, and the only programmers that people see are male geek actors on the TV, we will still have the geek image. I have to admit, most programmers I know are not ex-jocks. Most programmers I know are male, have interests in math and the insides of computers and will allow their personal appearance to slip during those wonderful, coffee-filled, marathon programming sessions. See, I have the disease too. (disease = stereotype)[5]

I believe that the author of the message is unusual not in having biases but in being aware of them. It has been empirically shown, as will be described in the

[4] Usenet, a large electronic bulletin board system, is described in the appendix on methods.
[5] Katz, Douglas J. Comp.society, May 14, 1990.

following sections, that many people expect less of females without realizing it. These stereotypes are not as harmless as the author implies however, as they sometimes impair people from seeing past the stereotypes. Additionally, people tend to live up or down to the expectations that are communicated to them.

1.1.2 Bias in Children's Toys and Computer Games

The social biases that influence females begin in childhood, where boys and girls are often treated differently on the basis of sexual stereotypes. From the earliest ages, girls are given different types of toys than boys. For example, one study of children from one to six years of age found:

> Boys had more vehicles, toy animals, military toys, educational-art materials, sports equipment, and spatial-temporal objects. On the other hand, girls had more dolls, doll houses, and domestic objects [Rheingold et al 1975].

The difference in toys cannot be explained purely by the children's preferences — the expectations of parents and other gift givers play a major role. Numerous studies, cited in [Pomerleau et al 1990, page 360] have found:

> When interacting with an infant who was introduced as a girl, adults used feminine toys (for instance, a doll) and talked more to 'her'. When the infant was presented as a boy, they used masculine toys (e.g., a hammer) and encouraged more motor activity.

These stereotypes are perpetuated by toy companies, which market toys in a stereotyped manner. A 1969 *Life* ad contained:

> Because girls dream about being a ballerina, Mattel makes Dancerina ... a pink confection in a silken blouse and ruffled tutu ... Barbie, a young fashion model, and her friends do the 'in' things girls should do — talk about new places to visit, new clothes to wear and new friends to meet.... Because boys were born to build and learn, Mattel makes Tog'l [a set of blocks for creative play].... Because boys are curious about things big and small, Mattel makes SuperEyes, a telescope that boys can have in one ingenious set of optically engineered lenses and scopes [Komisar 1972, page 305].

While such an ad would not appear today, it indicates the environment in which today's young scientists were raised.

As recently as 1985, a study found:

> [T]he content of toy catalogues and the pictures of children on the packages of toys are still strongly stereotyped. In catalogues and in stores, special sections are reserved for sex-stereotyped toys. Girls' sections contain dolls and accessories, doll houses, arts and crafts

> kits, toy beauty sets, and housekeeping and cooking toys. Building sets, sports-related toys, transportation toys, workbenches and tools are featured in the boys sections ([Schwartz et al 1985] in [Pomerleau et al 1990, page 365]).

In addition to marketing toys in a stereotyped manner, such factors influence the design of toys. It was reported that:

> Jaron Lanier, head of VPL, gave a talk at UIST in 1989 about his experience productizing the data glove for Nintendo games....[H]e said that [the] toy manufacturer was very strictly divided from the very highest levels into the girl's toy division and the boy's toy division. He strongly resisted the glove from becoming either a girls' toy or a boys' toy, but he lost. He said that they immediately categorized it as a boys' toy and put all kinds of black Darth-Vader-ish, sports-car-like paraphernalia all over it to make it appeal to boys. He also said, had it been categorized as a girl's toy, it probably would have been pink and frilly.

Not only are there differences in varieties of "old-fashioned" toys given to children, but these biases are carrying over into the realm of computerized toys and games. These games are both based on traditionally male interests, such as war and sports, and are marketed toward boys. [Kiesler et al 1985, pages 456–457] reports:

> On one rack [in a computer store], covers in comic-book style depicted such games as Olympic Decathlon (4 male athletes on cover), Cannonball Blitz (3 men in battle), Swashbuckler (9 male pirates), Thief (1 male detective), Alien Typhoon (1 male space explorer) and Money Munchers (1 man in a suit). In all, 28 men and 4 women were illustrated on the covers. The women were on the covers of Monopoly (2 men and 2 women playing the game), Palace in Thunderland (1 very fat queen), and Wizard and the Princess (1 wizard standing, 1 princess in supplicating position on floor).

Girls' lesser usage of computer games could be a factor in their being less positively disposed toward computers and in their lack of interest in computer courses [Lockheed 1985, page 118], particularly as students who have played computer games are more likely to do well in their first college computing course [Kiesler et al 1985, page 457].

It should be noted that nobody with whom I have spoken proposes that a conspiracy exists among manufacturers and advertisers to keep females in their place. Rather, companies aim their products at the largest segment of the population that is predisposed to use them. Additionally, females are more willing to buy products advertised for males than vice versa [Courtney et al 1983].

1.1.3 Stereotypes of Boys and Girls

Anecdotal evidence suggests that when an infant is dressed in blue, passers-by say how smart he looks; if the same baby is dressed in pink, people say how pretty she is. Boys' clothing is often decorated with cars and trains; girls' clothing rarely is. More rigorously, numerous studies of sex stereotyping of infants are reviewed in [Stern et al 1989], including:

> Parents in one study, for example, were asked to rate and describe their newborns shortly after birth when the primary source of information about the baby was his or her gender (Rubin et al., 1974). Although the infants did not differ on any objective measures, girls were rated as littler, softer, finer featured, and more inattentive than boys. Other studies have revealed that parents treat male and female infants differently.... Fagot (1978) observed that parents of toddlers reacted differently to boys' and girls' behaviors. Parents responded more positively to girls than boys when the toddlers played with dolls, and more critically to girls than boys when the toddlers engaged in large motor activity [Stern et al 1989, page 502].

Expecting different behavior from boys and girls can be a self-fulfilling prophecy: If one sort of behavior is expected and encouraged, the child will be more likely to continue it.

Children also have been shown to have formed sexual stereotypes as early as at two years old [Weinraub et al 1983, page 33]. For example,

> Preschool children also have a good grasp of adult-validated sex-stereotyped beliefs about children's behavior. When asked in an interview-like situation which of two paper dolls — 'Michael' or 'Lisa' — would like to do certain activities in nursery school, end up in certain future roles, and have certain character traits, children $2\frac{1}{2}$ to $3\frac{1}{2}$ years old showed an impressive depth of knowledge (Kuhn, Nash, & Brucken, 1978). Children believe that girls like to play with dolls, help mother, cook dinner, clean house, talk a lot, never hit, and say 'I need some help'; they also believe that boys like to play with cars, help father, build things, and say 'I can hit you' [Weinraub et al 1983, page 34].

The careers that children imagine for males and females are influenced by sex stereotypes. By the age of three years, most children "know that girls will grow up to clean the house, be a nurse, or be a teacher, and boys will grow up to 'be boss'" [Weinraub et al 1983, page 38]. These stereotypes affect the careers that children picture for themselves:

> Even preschool children express future aspirations along sex-stereotyped lines. Both preschool and elementary school girls choose a

> parenting role significantly more often than boys (Looft, 1971; Vondracek & Kirchner, 1974). In addition, the range of occupational choice is more restricted for girls, with nurse and teacher being the most popular answers (Vondracek and Kirchner, 1974; Beuf, 1974). Boys' choices include more action oriented occupations (police officer, sports superstar) and more prestigious careers (doctor, public servant, pilot).
>
> Taking the question one step further, Beuf (1974) asked children 3 to 6 years of age what they would do if they were of the other sex. Approximately 70 percent of the children replied with a job considered appropriate for the imagined sex. More interestingly, boys frequently imagined themselves as nurses and girls imagined themselves as doctors when asked, 'What if you were a girl (boy)?' Several girls confided that they really would prefer to be doctors rather than nurses when they grew up, but couldn't because they were girls [Weinraub et al 1983, page 44].

Thus, from an early age, girls and boys learn to think of most careers as being appropriate for either men or women but not both. This will influence not just their career choice but how they view males and females aspiring to "inappropriate" roles.

Unfortunately, these stereotypes are so pervasive that it is difficult for unprejudiced parents to prevent their children from accepting the stereotypes:

- A female computer scientist told me:

  > We ... have a rather non-traditional household, and I'm surprised at how traditional my two daughters seem to be turning out.
  >
  > Both my husband and I work full-time, but when we are home, [John] does almost all the cooking (I make a meal maybe once every three weeks), he cleans up after himself while cooking so I don't do much of the cleaning in the kitchen, I do the laundry (sometimes), and we let everything else go until a friend comes to clean our house and dig us out from under the laundry I never can seem to get to....
  >
  > [Once,] I asked my 5-year-old who did most of the work around the house, me or her daddy. She said "you". Now, this kid is totally guileless — she has not learned yet how to say one thing to one person and another to another, so I'm sure she wasn't just telling me this because I was the one who asked the question. So I said, "What kind of work do I do around the house? In the living room, in the kitchen?" She said, "You clean the kitchen." *I couldn't believe it!* I might have believed her if she said I occasionally picked up in the living room — but

> cleaned the kitchen? Her dad's domain? Where did *that* come from????

- Another parent reported:

  > When our daughter was very young — about 3 years old — we audiotaped an interview about what she would be when she grew up. After mentioning a number of possibilities my wife said, 'What about a doctor?' Jessica replied, 'Yeah, I could be a doctor.' Our son who was 5 at the time interrupted saying, 'I think you mean a nurse.' 'Yeah, a nurse,' Jessica said. My wife said, 'She could be a doctor if she wanted,' and our son replied, 'I don't think so...I've never seen any, at least not in Iowa.'

Stereotypes also exist specific to the computer world. One paper reports:

> We have even found that some young children believe computer games and computers are for boys. In one nursery school, Pratto (1982) asked girls and boys aged 3 to 5 to name the toys they played with. Both girls and boys reported that boys played with Atari; it was never mentioned as a game for girls. We returned to that school and asked 42 children whether they thought computers were for girls, and then we asked whether computers were for boys. Most children answered this question. Although the majority thought computers were for both genders, the boys were not as sure of this as were the girls (71% of the girls and 57% of the boys). Of the minority, more children thought computers were for boys only (14% of the boys and 11% of the girls) than thought computers were for girls only (7% of the boys and 4% of the girls) [Kiesler et al 1985, page 456].

The point of this section can be illustrated by the following incident:

> A group of parents arranged a tour of a hospital for a group of twenty children: ten boys and ten girls. At the end of the tour, hospital officials presented each child with a cap: doctors' caps for the boys, nurses' caps for the girls. The parents, outraged at this sexism, went to see the hospital administration. They were promised that in the future, this would be corrected. The next year, a similar tour was arranged, and at the end, the parents came by to pick up their children. What did they find, but the exact same thing — all the boys had on doctors' hats, all the girls had on nurses' hats! Steaming, they stormed up to the director's office and demanded an explanation. The director gently told them, 'But it *was* totally different this year: We offered them all *whichever hat they wanted*'" [Hofstadter 1986, page 156].

1.1.4 The Effects of Stereotypes on Teachers and Advisors

Additionally, stereotypes influence people who advise students, such as their parents, guidance counselors, and teachers. For example, [Stewart et al 1989] showed that, when given artificial case studies, high school teachers were more likely to advise male students than otherwise-identical female students to take courses that would prepare them for post-secondary institutions. Another study showed that high school girls "said that they had chosen business and commercial courses in order to prepare themselves for clerical jobs because they believed these were the jobs open to women" [Stewart et al 1989, page 261]. In response to a survey of female scientists,

> [M]any women felt they had been given inadequate advice on careers and choices of subject — careers advisers seemed to be fixated on nursing and teaching, and some were completely floored by requests for information about nuclear physicists or process engineers [Ferry et al 1982, pages 27–28].

Interviews with high school guidance counselors yielded similarly prejudiced advice to girls:

> A counselor in her early 30's: 'Well, if they bring me their registration card with (an AP [advanced placement] science course) listed I'll check to see if that's really what they meant... but I would never encourage it. I mean, it's usually their last year and there are so many fun things going on. I think they'll be busy enough and they can get into the serious work in college.'
>
> A counselor in her 20's: 'I just hate to see a girl get in over her head. I always try to place students at a level where I know they'll be successful. I mean, wouldn't it be frightful to spoil a beautiful record by doing poorly in a course your senior year.'
>
> A male director of guidance, mid-forties: 'Sure, I'm for the AP Program in general, but not for encouraging girls in science necessarily. Have you looked at the Bureau of Labor Statistics? It's a contracting market. There are men with Ph.D.'s in physics all over the place who can't get jobs. Why should we encourage girls? Why, if they're successful, they'd be taking jobs away from men who need them. No, it wouldn't be fair to the girls' [Casserly 1979, page 12].

Unfortunately, as the interviewer goes on to report, "these comments were chosen not because they were unique but because they represented all too commonly the attitudes of the counselors in many schools".

Additionally, even when girls are in science classes, teachers sometimes treat them differently, as shown by the following remarks from an interview of junior high school girls:

> So this teacher came down from the high school to give a demonstration in physics and said, 'Now this is going to make a pretty big noise, so any of you girls who don't like loud noises better cover your ears.'
>
> He said, 'Now this is going to be dirty so we'd better have a boy do it.'
>
> And he (a high school science teacher performing a demonstration to a sixth-grade class) said, 'Now this will help you boys who fix your own bicycles, so pay attention!'

(See also [Marriott 1991] and [Hall 1982].) The girls then go on to describe the difficulties they had in getting their parents to buy them tinker toys and chemistry sets, which are routinely bought for their brothers [Casserly 1979, page 9].

1.2 Ways that Males and Females are Treated Differently

In addition to the people who consciously believe women less capable, there are those who acknowledge that women can succeed at engineering but consider female engineers to be "somehow suspect" [Turkle 1984, page 200]. I will examine several aspects of this problem: First, based on their preconceptions of women, people often exhibit subtle forms of subconscious bias that cause them to treat women differently from men. Second, men and women are often held to different standards. Strange as it sounds, behaviors — such as succeeding — are sometimes considered attractive in men but not in women. Third, there is something about our culture's view of male-dominated fields such as engineering that causes female aspirants to be considered unattractive.

1.2.1 Subtle Bias

In [Sandler 1986, Sandler 1988, Hall 1982], there are summaries of several studies of subtle, subconscious bias — that is, people observably acting in a biased manner but unaware of their doing so. I was apprised of the importance of subtle bias by the number of respondents who objected to my call for "egregious examples", writing that they thought the subtle behavior to be more damaging. [Hall 1982, Sandler 1988] report the following biases, of which both men and women are guilty:

- Women are interrupted more than men.
- Faculty members make eye contact with male students more often than with female students.

- Faculty members are more likely to know and use the names of their male students than of female students.[6]

- Women are often asked fewer or easier questions than males.

As Sandler writes, "Singly, these behaviors probably have little effect. But when they occur again and again, they give a powerful message to women: they are not as worthwhile as men nor are they expected to participate fully in class, in college, or in life at large" [Sandler 1988, page 149]. Unfortunately, the message appears to have sunk in. Studies have shown that, when engineering students are asked to predict the academic performance relative to that of male and female colleagues, "both sexes anticipated that men would outperform women. This was paradoxical, since the average female student had both a higher grade point average and higher class rank from high school than the average male" ([Ott 1975] in [Zappert et al 1984, page 4]). Another study found that, when male and female college students were asked to predict their midterm test score before taking it, men had higher expectations for themselves than women did for themselves, even though the two groups actually performed the same [Erkut 1983, page 229]. Studies have found that women are more likely than men to attribute success to luck instead of skill [Deaux et al 1974] and to attribute failure to lack of skill [Ernest 1976, page 599]. Women's lack of confidence, and one consequence, is illustrated by an incident at Columbia, reported by Professor Joan Birman:

> I learned last year, to my astonishment, that for about four years running the honors calculus course had been all male, in spite of the fact that admission was based on an open competitive examination. This fall, one of the senior mathematics majors and myself made an intensive effort to encourage women to *try the exam!* The typical answer was, 'I know I won't pass it,' — to which we replied over and over, 'Well , if you try it, at worst you will confirm what you already know, and only an hour of time will have been lost.' After three days of such advising, the big day came, the exam was given, and this year the class has five men and five women! [Ernest 1976, page 604].

Not surprisingly, girls at single-sex schools study physical science and math more than in comparable coed schools, "even though girls' schools frequently have less adequate laboratory provision than mixed schools" [Kelly 1982, page 497]

Even more ominously, [Sandler 1986, page 6] reports:

> In one study, first done in 1968 and then replicated in 1983, college students were asked to rate identical articles according to specific

[6] The experience of women I have talked with is that if females are in an extreme minority, they stand out so much that the teachers are likely to know their names.

> criteria. The authors' names attached to the articles were clearly male or female, but were reversed for each group of raters: what one group thought had been written by a male, the second group thought had been written by a female, and vice versa. Articles supposedly written by women were consistently ranked lower than when the very same articles were thought to have been written by a male [Goldberg 1968, Paludi et al 1985, Paludi et al 1983]. In a similar study, department chairs were asked to make hypothetical hiring decisions and to assign faculty rank on the basis of vita. For vitae with male names, chairs recommended the rank of associate professor; however, the identical vita with a female name merited only the rank of assistant professor [Fidell 1975].

Anti-female bias is strongest in traditionally male fields [Top 1991, pages 96–97].

When discussing the results of such studies with fellow students, I found that the males have tended to be more surprised than the females, because many females recalled specific instances of biased behavior, several categories of which are represented below.

In some cases, a woman was viewed as less serious than a man in a similar position:

- A female computer science graduate student had the following experience:

  > I was working at a fairly small company whose communal coffee was *awful.* A group of 6 of us (4 men, 2 women) bought our own coffee maker and had decent coffee which we paid a few cents for to defray the costs of coffee and cream. Anyway, I usually bought the coffee and my male coworker usually bought the cream. A new member to the group (male) approached me and told me we were out of cream. I told him that M2 usually bought the cream. Later that same day, M1 again comes up and tells me we are out of cream. I once again tell him that M2 gets the cream. To this he says, 'But how can I bother M2 with something as insignificant as buying cream?' Needless to say, I told this fellow exactly what I thought about that...

- One female graduate student in mechanical engineering sent the following two stories:

  1. When I first started the [graduate] program, the head of the department (male) was assigning desks to graduate students... ([T]here were two entering females to the particular program at that time.) As he ran out of desks, he said, 'Well, just put the girls together on a desk.'
  2. That same professor put me (a newly graduated math major) into the slower (undergraduate) statistics class, and put a guy who had had

> a vague introduction to stats 8 years earlier in the faster (graduate) class.

Both events took place in the past two years, a time period which she has found "very frustrating".

- A female computer consultant wrote:

  > Most of our users ask for and accept help from whichever consultant is available, but some insist on talking with one of the male consultants (only 2 of the 10 consultants are male). One user persisted at this, even after Alan explained to her that he didn't know the package she was working with, and that she would be better off asking me because I specialize in that particular software. Another user did ask me her question, but when she didn't like the answer I gave her (I explained what she could not do and why), she insisted on taking her problem to David (a higher authority?), who proceeded to tell her exactly what I had just explained. What is interesting about the latter incident was that she did not seem to be after a second opinion, because she could have gotten that from a number of people (all female). She apparently specifically wanted a male opinion.

- When a female computer science undergraduate visited one of the graduate schools to which she had been admitted, she and a male prospective student met with a male graduate student to discuss the school. Whenever the woman asked a question, the graduate student directed his answer to the male prospective instead of to her, i.e. by making eye contact and gestures toward the male prospective. This treatment surprised the woman, as she had not encountered such behavior at her undergraduate institution. After the meeting, she delicately pointed out the behavior to the graduate student, and he apologized profusely and sincerely, clearly unaware of the bias while it was occurring. When they met later in the day, his behavior was markedly better. The same woman, however, in a later meeting with two other graduate students, one male and one female, found herself addressing most of her questions to the male until she recognized her behavior and corrected it.

1.2.2 Different Expectations for Men and Women

The following examples show how people sometimes expect women to be less interested or competent in technical areas than they actually are:

- According to a survey of female scientists:

> Women in mainly male environments are always being taken for secretaries or junior laboratory staff: queries may be addressed to a male technician rather than his female boss. An engineer offering to help a telephone caller was told 'No dear, this is a technical enquiry. Can I speak to someone who can help me?' [Ferry et al 1982, page 28]

- A female computer science professor told me this story:

  > I was visiting a university and arrived before my (male) host. I approached the departmental receptionist to try to make certain arrangements. In one case, I suggested that my host might have made some provision — 'or,' I said cordially, 'maybe not.' 'Oh, probably not,' replied the receptionist. 'After all you know those professors...' Boy was *her* face red when she realized what she'd said.[7]

- A female undergraduate at a women's college wrote:

  > The summer after my first year at [X] I took Linear Algebra at [a coed college] nearby. Out of probably twenty people in the class, I was one of two women. I found that the mood of the class was stifling. It was obvious that the men of the class expected me to sit quietly in my chair and contribute nothing and ask no questions. It was also made obvious to me that, in general, they felt they were far superior to me. Because I had had no contact with them outside of the classroom, I must assume they were basing their decision solely on the fact that I am female. In addition, I found the material relatively easy and was getting an A in the class, so they could not be basing it on my academic performance. One day as we were going over a difficult problem set we had had for homework, the professor asked if anyone was able to do a particular problem which I had been able to solve. When I raised my hand, [a student made] the comment 'What?!?! How could *you* have solved that problem!?!?' He in no way hid his hostility or his feelings that if he, a far superior man, could not solve the problem, I could

[7] It is fascinating to read about how female professionals and secretaries interact with each other. One professor reports that she used to sneak to the typewriter and type her own letters, rather than ask a secretary to do the work for her. Correspondingly, secretaries generally do not like to work for women. "They experience women's authority as 'unnatural', whereas men's authority is taken for granted" [Pringle 1989, page 58]. Additionally, as hinted by a comment in [MIT 1983, page 21], female secretaries feel demeaned when female professionals complain about being mistaken for secretaries. On the other hand, most of the secretaries I have worked with have treated me the same as they treated my male colleagues, and one has even told me outright how happy she was to see women as computer professionals.

> not have. I was completely shocked that he could make such a comment. No one else seemed to be. It is no wonder that women tend not to contribute in a male-dominated classroom.

- A female computer scientist sent me a copy of the cover of a prestigious computer periodical that showed a family (parents and a boy) looking at a computer. A bubble next to each shows what they are thinking. The mother is imagining her son using the computer to learn math and the father using it to figure taxes. The son and the father both imagine using the computer to play space war games.[8]

These diverse examples illustrate how women are sometimes treated as less capable or interested in technology than men, instead of being treated as individuals. Of course, there exist professors and administrators who treat their male and female students equally as well or even devote extra effort to encouraging women. However, negative events are still common enough to be of substantial concern. Moreover, the above behaviors are the symptom of a more fundamental problem: lower expectations for females. Many of the above events are too blatant to have the insidious effect of subtle discrimination (which probably accompany them). Even if the perpetrators could be coerced into not so openly displaying sexism, it would not eliminate the fundamental biases which would be displayed less directly.

1.2.3 Different Standards for Men and Women

As Sandler writes, the same behavior is viewed differently in women than in men:

> He is 'assertive'; she is 'aggressive' or 'hostile'. He 'lost his cool', implying it was an aberration; she's 'emotional' or 'menopausal'. Thus, her behavior is devalued, even when it is the same as his [Sandler 1988, page 151].

This claim can be illustrated by a recent lawsuit by a woman who "repeatedly heard that she had not been given a partnership at [a] huge accounting firm because she was too macho, universally disliked and in need of 'a course at charm school'" [Lewin 1990]. This is despite having brought in more business than any of the other 88 candidates for partnership. "Comments from the lawsuit [say] that she should wear makeup and jewelry and learn to walk, talk and dress 'more femininely'" [Lewin 1990]. A survey of female scientists found:

> Most think their male colleagues are more forceful and aggressive than they themselves want to be; some have resigned themselves to low status rather than changing their personalities, while others

[8] Cover, *IEEE Computer*, March 1977.

> have decided to fight with men's weapons — and are often labeled unfeminine as a result [Ferry et al 1982, page 30].

One study found the same behavior judged more harshly in female professors than in males:

> [According to] Susan Kay's classroom studies... male students were far more likely to give lower ratings to those female faculty perceived to be hard graders... This finding is consistent with a series of experiments at the University of Dayton that indicated that college students of both sexes judged female authority figures who engaged in punitive behavior more harshly than they judged punitive males... ([Martin 1984, pages 484–485] in [Koblitz 1990]).

See also [Kierstead et al 1988] and [Bennett 1982].

A "halo" effect seems to exist where people tend to interpret behavior according to their preconceptions. The same action is often interpreted differently, depending on whether it is performed by a woman or a man, as the following stories illustrate:

- When a high-ranking female engineer was at the airport to make a business trip, she saw a male acquaintance who worked for the same company. He asked where she was going, and she answered San Francisco. He then said something like, 'Oh, going to do some shopping?' She told me how angry his remark made her, as she works extremely hard at the company, putting in long hours and taking frequent business trips, with too little free time for her to go on out-of-state shopping trips even if she were inclined to do so.

- A female computer science graduate student told me that it is common to see different reactions to men and women dropping a class. According to her, when a woman drops a class, people remark that the class must have been too difficult for her; when a man quits, people say he must not have found it interesting.

These examples are troubling because they show one way in which stereotypes are perpetuated. In each case, someone interpreted the actions of a woman based on their prejudices, reinforcing their own stereotypes.

Additionally, women at American universities are often the victims of other cultures' stereotypes. Foreign nationals outnumber Americans as students in doctoral engineering programs [Widnall 1988, page 1740], and there are many foreign-born professors. In one survey, female graduate students at MIT "reported that foreign-educated faculty — many from cultures where women are not held in high esteem — pose problems for women in graduate programs, both in class and in research" ([MIT 1987] in [Baum 1990, page 49]).

1.2.4 Career-Related Success Unfeminine

Not only are some strong traits considered unfeminine, but "femininity and individual achievement continue to be viewed as two desirable but mutually exclusive ends," a shocking position argued in [Horner 1970, page 46], based on empirical research and interviews. In one of Horner's studies, females were given the sentence "After first-term finals, Anne finds herself at the top of her medical school class." Males were given a similar sentence with a male name. Subjects were asked to write a story about the student. While only 8 of the 88 male subjects exhibited fear of success through negative stories, 59 of the 90 females did. Horner divides the negative stories into three categories and includes sample stories, of which I include a subset:

1. Fear of Rejection — "Anne doesn't want to be number one in her class. She feels she shouldn't rank so high because of social reasons. She drops down to ninth in the class and then marries the boy who graduates number one."

2. Concern about Normalcy or Femininity — "Anne is completely ecstatic but at the same time feels guilty. She wishes that she could stop studying so hard, but parental and personal pressures drive her. She will finally have a nervous breakdown and marry a successful young doctor."

3. Denial — "Anne is really happy she's on top, though Tom is higher than she — though that's as it should be.... Anne doesn't mind Tom winning" [Horner 1970, pages 60–62].

Additionally, when questioned about Anne, "[m]ore than 70% ... described Anne as having an unattractive face, figure, or manners" [Horner 1970, page 63]. Females thus consider success to lessen their femininity, a sacrifice many are not willing to make [Horner 1970, pages 69–72]. See also [Mednick et al 1975].

This attitude can also be illustrated by the following incident, reported in [Franklin et al 1981, page 20]:

> One woman earned high grades in a traditionally male field. Her professor announced to a mostly male class that this represented an unusual achievement 'for a woman' and was an indication, first, that the woman student was probably not really feminine, and, second, that the males in the class were not truly masculine, since they allowed a woman to beat them.

Instead, the proper area for a woman's success is seen as her ability to attract high-status men. In a study for the National Institute of Education, researchers Holland and Eisenhart found:

> Men's prestige and correlated attractiveness come from the attention they receive from women *and* from success at sports, in school

> politics, and in other arenas. Women's prestige and correlated attractiveness come *only* from the attention they receive from men [Holland 1990, page 104, emphasis in original].

This attitude is exemplified by the way one college woman attempted to insult another: "[You] may be able to do calculus, but I'm dating a football player" [Holland 1990, page 104, brackets in original]. The study found that female friends often did not even know each other's majors [Holland 1990, page 14], although they spent large amounts of time together discussing other matters, primarily boyfriends [Holland 1990, page 14].

1.2.5 Implications of Gender Double Standards

The double standards discussed above should be a significant concern. Aggression, competitiveness, and even some brashness are necessary for a graduate student, for example, who must compete with other students for equipment, funding, and attention from professors. One doesn't get far by politely waiting to be noticed or for other people to stop using the computer. In her paper on being a female graduate student at MIT, Candace Sidner addresses some stumbling blocks women face:

> Receiving an advanced degree, in fact, any degree, from MIT is rather like being admitted to a fraternity. One has a certain set of rituals to go through, and both the process and one's performance define one's position in the fraternity in the years that follow....
>
> It surprises no woman to say that women are socialized differently than men in our cultures. What is surprising is the effect of that socialization when women take roles traditionally held only by men. The most significant role change centers [on] developing confidence and competence. Part of the process of hurdle jumping is not just the getting over, it is the form which one presents in doing it. For the MIT fraternity ritual, the form is confidence; a woman student must use what I call strutting behavior, that is, she must look and act like she knows what she is doing.
>
> While developing confidence from accompanying competence, is difficult for all initiates, for women there is a subtle, but remarkable difference; women in the everyday world are not supposed to appear very confident and competent.... As a result, women must not only build and show confidence and competence, just as their male counterparts do, but unlike the men, they must *decide* first to unlearn their normal behavior patterns....
>
> The strutting behavior appears slowly; there are stops and starts, forward and backward progress. A woman student begins to act from a little bit of confidence in her competence, and tests out this confidence among her peers and superiors. Two more difficulties

> follow. First, a woman feels less feminine, because in fact she is less feminine according to the prevailing behavior patterns. In her personal life, her feelings may be communicated to her partner(s) who may find her less attractive. This threatens her personal status. Eventually a woman can learn to find personal friends who value her confident image, but the time in between is frightening [Sidner 1980, pages 2–3].

Empirically, a comparative study of male and female Stanford graduate students in technical areas [Zappert et al 1984] found that women were less self-confident and assertive than their male peers:

> [W]omen less frequently than men reported that they felt free to disagree with their advisors...and that their ideas were respected by their advisors [Zappert et al 1984, page 9]....
>
> [W]omen more often reported having trouble saying "no" and in giving criticism. Women also more often reported having difficulty sticking up for themselves and tended to let annoyances pile up [Zappert et al 1984, page 12].

1.2.6 Specific Stereotypes Against Female Engineers

As if the culture-wide inhibitions to success were not enough, there are additional barriers in engineering. Nowadays, high school girls from middle- and upper-middle-class families are expected to go to college and to do reasonably well, but going to a technical institute or majoring in a technical field is still considered unfeminine, as these anecdotes indicate:

- When a female student at an engineering institute went home for vacation, her mother leafed through the book of photographs of the freshman class and exclaimed in surprise, "Why, some of these girls are pretty!"
- A male computer professional wrote:

  > Back in 1983, I was a freshman here at [X] and one of my friends was a genius who happened to be a pretty blonde girl....
  >
  > She was also a freshman and spent one of her first days here searching for her advisor's office. While hunting around [Y] Hall, a man in his early 30's came up to her and asked if she needed help. She said that she was looking for her advisor's office. The man responded with a puzzled, 'What major are you?' When she answered, 'I'm in Electrical Engineering.' The man smiled at her and oozed, 'Oh, you're *far* too pretty to be an EECS major.' [She] immediately left and told us in the dorms about this slimy guy.

> The next day we went to our first lecture for [the introductory computer class]. [She] gasped as one of the lecturers entered the hall. He was the same slimy guy she had encountered the day before....
>
> I'll never forget the quote, "Oh, you're *far* too pretty to be an EECS major."[9]

- A male computer professional wrote:

  > I used to teach undergraduate computer science classes, and saw a number of cases in which very promising and talented women abandoned computer science, much to my disappointment since they were some of my better students.... At least where I was teaching, the discouragement from that field was given more by other women, particularly in the sororities, rather than from within the field itself.

It is worth repeating, however, that the stereotype of male engineers is almost as bad. Jokes and television portray male engineers as unattractive, unpopular, awkward, and either unsuccessful with or uninterested in women.[10] However, I believe that in our culture, females are more susceptible to such stereotypes. This is in large part because, as described earlier in this chapter, femininity is considered to be at odds with success, while masculinity is not.

While the stereotype that female engineers are inherently unattractive seems to be without rational basis, scientific fields may well be in conflict with some values traditionally thought of as feminine and currently held by a majority of females. The situation seems not to have changed since the following was written:

> I think [women's lack of achievement] comes from the general orientation of girls, young women, and even older women, toward 'others' (in David Reisman's sense of being 'other directed'). Women are constantly urged to consider 'Am I doing the right thing?' and 'What shall I be or do that will please my husband, children, and parents?' Occupational success never comes out as the positive answer to these questions. Pleasing others and doing the 'right thing' always means holding back, and retreating from a position of strong ambition and career commitment [Epstein 1974, page 15].

I would add that being other-directed might steer women away from objective sciences into the humanities and the more people-oriented social sciences. Thus,

[9] In a later note, the writer added: "[The teacher] was fired two years after this incident. According to my advisor at that time, his attitude toward female students was one of the reasons. (He was not tenure track. He was a lecturer only.)" This story was later confirmed by a former professor from the university.

[10] See [Turkle 1984] for an interesting discussion of the male engineering student's self-image.

the values that are encouraged in women would not only make them less career-oriented but more likely to avoid the sciences.

1.3 Summary

In our society, males and females are regarded very differently. Assertiveness, confidence, and high achievement are considered consistent with masculinity but not with femininity. In addition to the stigma associated with success in general, technical fields are considered particularly unattractive for females. These factors can influence a girl not to pursue an interest in math or engineering, and they can sabotage a woman's career because either she acts feminine, e.g. demure, and is not taken seriously, or she acts masculine and is met with disapprobation. Of course, as mentioned in [Sidner 1980, page 3] and [Horner 1970, page 70], confident females eventually find male and female friends who like and respect them. The problem is thus not insurmountable. Still, it is an additional barrier that females face, and the playing field will not be level while these stereotypes exist.

Chapter 2

The Masculine Environment

> *I do not see that the sex of the candidate is an argument against her admission... After all, we are a university, not a bathing establishment* — David Hilbert, arguing unsuccessfully for the appointment of Emmy Noether to the faculty at Göttingen.[1]

Currently, the majority of professionals in computer science departments and workplaces are male. As a consequence, these places often have masculine environments in which women feel uncomfortable or unwelcome. The behaviors described in this chapter are generally not meant to be harmful to women, which makes the participants often hostile toward criticism. Such behaviors include the display of nude pictures, discussing sex, telling dirty jokes, and expressing negative stereotypes of women in an attempt at humor. Additionally, other activities are morally faultless, such as coworkers playing basketball together, but they may tend to make a woman feel less part of the group if she does not enjoy the same activities.

2.1 Sexist or Sexual Humor

Often, men make sexist or sexual remarks in attempts at humor. As the following examples show, this happens in classrooms, computer magazines, and at conferences. In most of these cases, the speaker probably means no harm. However, the behavior makes some women feel uncomfortable. In order to highlight the effect such statements have on women, their reactions have been included where available.

[1] Weyl, Hermann. "Emmy Noether", *Scripta Mathematica*, VIII, 3 (July, 1935), page 207.

- A female graduate student had the following experience:

> [A professor] in the introductory part of a guest lecture on robotics to the graduate core AI class: (approximate quote) 'Pretty soon we'll have robots that are sophisticated enough to wander around in shopping malls and pick up girls.' I didn't listen to the rest of the lecture, so I don't know what else he had to say.

- A female computer science professor wrote:

> When I was in graduate school, the professor in automata theory introduced the topic of decomposition by saying: 'Machines are a lot like women — many forms for the same function (wink wink).' As the only woman in the class, you can imagine that I felt terrific. And all of a sudden the guys sitting next to me sort of tensed up — instead of a fellow student, his remark had made them see me as something else, something kinda dirty.

- The narrator of the industry gossip column in the trade journal *Infoworld* is an adult male with a young girlfriend Pammy, shallow and uninterested in computers, whose silly statements and actions pad the columns, such as her return to beauty school. ("[A]t 21 she's older and can handle the pressure now.")[2]

- A female computer science professor wrote:

> [A]t a conference in France, a male speaker (French), who was speaking about the importance of testing, showed an overhead slide of a naked woman with a caption of the sort — 'Would you buy this product without testing it first?' There were only 2 or 3 women in the audience (of about 150), but I had fleeting feelings of having accidentally walked into a stag party and wondering if he had either not expected any women to be there or had discounted the importance of directing his remarks to the women in the audience.

What these examples all share is that the male speaker or writer was attempting to make a cute statement but that females (and some males) had negative reactions.

[2] Cringely, Robert X. "Notes from the Field". *Infoworld*, September 17, 1990, page 108.

2.2 Sexual Displays and Discussions

2.2.1 Different Reactions

At the workplace, many women feel uncomfortable with the "locker room atmosphere", which includes pictures of nude or partially nude women on posters or computer screens and the telling of dirty jokes. Unlike the sexist remarks described above, however, there is disagreement among women on how inappropriate these actions are, with a significant number of women not personally offended by the behavior (although some of these women oppose it on the grounds that it upsets other women). This point is illustrated by the different reactions in the following examples:

- When a graduating engineer was touring a company that wanted to hire her, they took her through the laboratory, which had a pin-up on the wall. The other people in the lab (men) and the men showing her around seemed oblivious to the poster and to her discomfort. She felt uncomfortable with the idea of working in a laboratory with a picture like that up and ended up refusing the offer, partly for this reason.

- When a graduating computer scientist was taken out to lunch by engineers of a small computer company, one of the topics the employees (all male) discussed was a series of lingerie shows in the region. The student did not feel uncomfortable about the subject matter, and it did not affect her decision about the company, but she thought it was something which might make other female interviewees uncomfortable.

- When a computer science undergraduate had recently begun working in a research group at her university, some male graduate students entered the office and began playing an "adult" computer game, "Leisure Suit Larry," crowding around the screen, discussing the game loudly. The undergraduate left the office because the situation made her too uncomfortable for her to work there. When she recounted the story a year later, she said that she would not react the same way now and would either be able to keep working or would say, "Hey, get out of here, guys." The change was due to her feeling more confident about her position in the group and knowing the individuals personally.

One female computer science student explained one reason that some women are offended by sexual humor while others do not understand what the fuss is about:

> I have noticed that how offended I am by [gender-related humor] depends very strongly about how comfortable it is to be female and in the present environment.

> When I first entered grad school in the CS [X] group at [Y], there were some women graduate students, but only a couple. A secretary deliberately placed me, when I arrived, sharing a desk with a male graduate student who was at that time desperately trying to find a woman (she was trying to be nice) — a professor had a 'funny' newspaper article about [a sexual topic] posted outside his door. Don't get me wrong, I found nearly no-one among the faculty and graduate students who was anti-women or took me or my work or my concerns any less seriously than any other first-year student. Still, the graduate students were 90 percent men, and they talked all the time about how hard it was to meet 'available' women, and as a first year student trying to establish myself within their community, I found the 'locker room' atmosphere oppressive and daunting. If someone had sent around [a sexist joke through email] that year, I think I would have hit the roof. In a world where I was struggling to find my place, it would have just helped to undermine it.
>
> Today the graduate student population in CS [X] has quite a few more women, and is much more comfortable. Instead of the "guys" in school here, it's the 'people' in school here.... In my current environment I might have easily [passed along the joke] to my [male] office-mate.

2.2.2 Attempts at Changing Behavior

Some computer science graduate students and staff at Carnegie Mellon were sufficiently disturbed by the display of nude pictures as backgrounds on computer terminals that they got together and tried to change the situation by publicly appealing to the community. [CMU 1989] is a fascinating report describing their appeal and the friendly and hostile reactions. Their appeal included the following passage:

> When a woman sees such a display on your workstation, is she likely to believe that you take her seriously as a fully contributing member of the department? Rather, she may feel that you could be a source of sexual harassment, and feel hostile towards you, or nervous about working with you. If so, that is a loss for you, for her, and for all of us. Among the visitors to the department, some of whom are prospective students, staff, or faculty, there are surely some who will view us as unprofessional if they see these displays, and this hurts us all, too. Conversely, an environment more hospitable to women — specifically, one in which relations between women and men are less strained — is of clear benefit to men as well.
>
> For some people, displays of naked women on workstations, or elsewhere in offices, remind them of the forces in our culture that view

> women as sexual playthings, not as men's peers. For others, such reactions do not occur. People who are offended will interpret such displays as derogatory, even if that is not your intent. We therefore ask you to refrain from using them out of respect for those who are offended, even if you believe the offended people are just overly sensitive [CMU 1989, page 2].

The appeal closed by making clear that they were not advocating banning such displays but were requesting that people voluntarily remove them out of sensitivity to others. Responses about the appropriateness of the displays and of the appeal were mixed and are categorized in the report. Negative reactions included the position that the writers were advocating censorship "like the Nazis or the Ayatollah Khomeini," that people should not be asked to change their behavior merely because of what others might think, and that a public appeal was inappropriate but instead should have been made by individuals to individuals. Of those agreeing, the majority of responses said that the request was reasonable and not an attempt at censorship, that it prevented people from unintentionally giving offense, and that it was effective at raising consciousness. In response to the criticism that individuals should complain personally, several women wrote that "[w]omen asking for changes in behavior individually are exposed to ridicule and abuse" [CMU 1989, page 4]. This point was echoed by a woman quoted in a paper about the "Garden", a laboratory in the MIT Media Lab:

> [W]hen comments are made about the offensive nature of the music or movies, they are often ignored, or belittled, or are chortled at. Ironically, once you are labeled a feminist in the Garden, your comments are taken less seriously, because you are considered radical and your judgment less fair [Tidwell 1990, page 14].

Both the Carnegie-Mellon and Garden papers conclude that the attempts at changing people's behavior were somewhat, but not highly, successful.

2.3 Behavior Due to Sex-Correlated Differences

An additional category exists of behavior that is not directly based on sex but which nevertheless discourages women. While attempts at changing sexist behavior are partially effective, there seems little that can be done about this category.

2.3.1 Socializing with Co-workers

Through no real fault on any side, a woman sometimes feels out of place being one of the few women in a semi-social gathering with a group of men, even in the absence of any behavior directly related to the sex of the participants. One reason is that, in our culture, men are often interested in activities or topics that women tend not to relate to.

A female graduate student complained about her experiences as a teaching assistant (TA) for a course in a particularly male-dominated area of computer science. She wrote:

> Perhaps because the percentage of males is often high, men tend to dominate non-academic discussions with topics of interest to them, such as sports and cars, topics which women are often uninformed about or uninterested in. The resulting inability to participate in discussions can make it difficult for women to bond socially, and often leads women to feel outright alienated... This is exactly what happened to me at each T.A.–faculty meeting.

Another female computer science graduate student described a similar experience:

> My first summer at [a certain computer company], I worked in a group that was otherwise all male. While I got along okay with them and never had any behavior to complain about, I didn't socialize with the group. For example, every day after lunch, they would go outside to 'shoot some hoops' [play basketball], an activity that I just did not relate to. For my next summer, I joined a group that had other female programmers and a female manager. I was much happier in that group. We would have barbecues, celebrate people's birthdays, and socialize in other ways that I related to better than 'shooting hoops'. My third summer, I chose to return to this group and not to the first one or to find a new group.

However, when she casually discussed her social dissatisfaction in an exit interview with the department head, he pointed out that, coming from a different country, he did not relate to American sports either. This raises the important point, which holds for all examples in this section, that dissatisfaction with certain activities is not strictly divided by sex. There are individual women who enjoy sports and are better at them than some men. Sex-based differences are a tendency, not a fixed rule. Sex-correlated preferences in our society, however, are strong enough that these phenomena tend to work against women (or whoever is underrepresented in a group).

Additionally, female group members do not always feel comfortable joining male group members who go out drinking together. Not only might they not enjoy drinking, but some men are inclined to making lewd remarks after a few drinks. Thus, there are often times when women feel unable to take part in activities to which, as group members, they are invited.

Another problem is that some men do not feel comfortable socializing in a professional manner with a woman, as this anecdote illustrates:

> I was ... the first full-time woman faculty member in my department. There really was difficulty among my male colleagues in associating with a woman as a colleague. I think they literally did not know how to talk to me, and as a consequence often just did not talk to me. They would ignore me. They would not invite me to have lunch with them, which was a very ordinary experience there ... they would walk past my office and ask the next person and never ask me. [Years later] I asked one of my colleagues why this was so. And he said, 'You know what would happen if I asked you to lunch ... People would talk' ([Clark et al 1986, pages 36–37] in [Sandler 1986, pages 7–8]).

2.3.2 Different Communication Styles

The language that women use often differs from that of men in subtle ways. As discussed in [Hall 1982, page 9], specific constructions appear more frequently in women's speech than in men's:

- hesitation and false starts ('I think...I was wondering...')
- high pitch
- 'tag' questions ('This is really important, don't you think')
- a questioning intonation in making a statement ('The second chapter does most to clarify the theme?')
- excessive use of qualifiers ('Don't you think that *maybe sometimes*...')
- other speech forms that are excessively polite and deferential ('This is probably not important, but...')

As Hall concludes:

> If, for example, a woman student begins her comments hesitantly and uses many qualifiers, she may be immediately perceived by her teacher and by her classmates as unfocused and unsure of what she wants to say. Her 'overly polite' style may seem to 'invite' interruptions by, or inattention from, both teacher and other students. Indeed, even the most insightful points made in this manner — *especially by a woman* — may be taken less seriously than the identical points made by a man or delivered in a more 'masculine' assertive style [Hall 1982, pages 9–10].

See also [Lakoff 1975].

A large part of Jenifer Tidwell's report on the Garden [Tidwell 1990] describes how men and women react differently to the same treatment, due to their expectations of communication styles:

> The persons I interviewed did not believe that women were treated worse than the men were, nor vice versa, when I asked them directly. ('Everyone is treated equally badly,' said one male informant.) Yet some informants, both male and female, commented that women may not be able to deal with the Garden's harshness as well as the men do — not because of any inherent weakness, but simply because they have not been brought up with the same expectations of 'toughness' (in one man's terms) that men have. Furthermore, it seems more acceptable for anyone there — male or female — to try to solve all one's problems by oneself than to habitually ask for help. All of the women that I interviewed commented on this expectation of independence (whereas almost none of the men did); they did not like it [Tidwell 1990, page 9].

Tidwell writes that the attitude is that "[what could be construed as] harassment may just be social incompetence" [Tidwell 1990, page 15, brackets in original].

Anecdotal evidence suggests that women tend to be more sensitive than men to general obnoxiousness [Widnall 1988, page 1744]. When a female computer science student told me that a male TA had been inexcusably rude to her in front of the class, I looked up the student evaluations of the TA and found this comment, by another student:

> [He] knows his stuff cold, but he's too rude. Honestly, once you humble yourself and tolerate this, he is an excellent source of help. I owe a lot to him.

A student unused or unwilling to being treated rudely would not be able to interact with such individuals.

When I sent electronic mail to a group of women asking for criticism on the first version of this report, one woman replied that my request was unlikely to draw many responses. Instead of asking for "criticism", she told me, I should have asked for "feedback to help me improve the report", something women would feel more comfortable supplying.

Steven Levy's *Hackers: Heroes of the Computer Revolution* extensively describes the hacker culture, including the hackers' apathy and even antipathy toward women.

> Maybe it would have been different if there had been more women around TMRC [Tech Model Railroad Club] and the ninth floor — the few that did hang around paired off with hackers.... There were not too many of these women, since outsiders, male or female, were often put off by the group: the hackers talked strangely, they had bizarre hours, they ate weird food, and they spent all their time thinking about computers [Levy 1984, page 72].

Levy goes on to describe the poor hygiene of one of the most admired hackers, a young man who did not bathe [Levy 1984, page 73].

Male computer environments that exclude women have occurred as early as in preschool:

> Even in preschool, males dominate the school computers. In one preschool, the boys literally took over the computer, creating a computer club and refusing to let the girls either join the computer club or have access to the computer. When the teachers intervened and set up a time schedule for sharing computer access, the girls spent as much time on the computer as the boys [Kiesler et al 1985, page 454].

While it is not clear that one can justify the stereotype of the engineer and computer hacker as socially backwards, women are deterred by the environment.[3] (See [Markoff 1989], for example.) Additionally, whether the stereotype is accurate is to some extent irrelevant: If females believe that to study or work with computers requires hanging around socially incompetent nerds, the stereotype, true or false, may influence their decision.

2.4 Finding a Mentor

Having a mentor or sponsor can be of vital importance to a graduate student or junior professor:

> The sponsor may serve many functions for the protégé. First, the sponsor introduces and initiates the protégé in the customs, demands, and expectations of academic life. Second, the sponsor shares his or her wisdom and knowledge with the protégé, and provides encouragement and comments on his or her work. Third, the sponsor can provide career assistance for the protégé by making recommendations to his or her colleagues at other institutions, or simply by sharing a bit of the deflected glow from his or her own shining reputation. Perhaps most important, the sponsor helps to form with the protégé the sense of him or herself as a member of the profession, encouraging and fostering a self-image as a legitimate member of the community of scholars [Simeone 1987, page 101].

Despite the importance of having a mentor, there are few formal policies to ensure that every graduate student or junior faculty member receives mentoring. Although every graduate student, for example, has a thesis supervisor, the supervisor typically devotes different amounts of energy to different students. It is reported that "women are more likely than men to be excluded from this sort of relationship with senior faculty" [Simeone 1987, page 102] [Hall 1982, page

[3] It is worth noting, however, that some men are disgusted by the hacker culture, such as MIT professor Joseph Weizenbaum [Levy 1984].

10]. There are several possible reasons for this exclusion. First, as discussed above, some men feel uncomfortable dealing with women as professionals. Second, some "faculty men may see women as being different from themselves, less intellectually able, less committed and dedicated, or simply inappropriate for academic careers" [Simeone 1987, page 103]. Third, when men and women work closely together, there is the risk of their being suspected of having an affair [Simeone 1987, pages 82–83]. Additionally, many people like to help people who are "like" them, i.e. of the same sex or race. (Indeed, that was a motivation for my writing this report.) As long as most of the people in positions of power are men, and as long as differences in sex are considered to be of great importance, junior men will benefit.

2.5 Behavior Specific to Technical Events

Computer trade shows and technical conferences are often even more male-dominated than the workplace and university. Some of the specific problems of these events are discussed in this section.

2.5.1 Trade Shows

Men far outnumber women at industry and academic conferences. At trade shows, particularly, companies have "historically employed attractive women to draw attention to product exhibits or booths" [LaPlante 1989]. While this practice has been declining, an industry journal article about Comdex 1989 reports:

> A number of companies still insisted on hiring scantily clad female models to attract attention to their booths. And a party thrown by Fujitsu went far beyond questionable taste, seriously offending Comdex attendees of both sexes [LaPlante 1989].

Additionally, when women do attend, they are suspected of not being legitimate attendees:

> [PFS Inc. president Mary] Rich remembers attending the National Computer Conference (NCC), a now-defunct computer convention, where the male attendees outnumbered the female ones by a ratio of 300 to 1. Convention officials as well as hotel staffs were extremely suspicious of single women, Rich said. Women were often suspected of being prostitutes trying to solicit show attendees. Rich said she once tried to go to the hotel room of a colleague for a drink only to be kicked out by security when trying to get in an elevator.
>
> Rich, who co-chaired the 1986 NCC with another woman, said that as recently as three years ago one of the primary concerns was how

> women were being treated at the show. 'We still had problems with security not believing [the credentials of] women trying to get onto the show floor,' she said [LaPlante 1989].

2.5.2 Technical Conferences

Women are treated better at technical conferences than at trade shows. While I have never seen any reports of a female speaker or attendee being mistaken for a prostitute, people sometimes assume a woman to be the wife of an attendee and not an attendee herself. Additionally, female computer scientists complain of being propositioned by male attendees. While this probably happens at trade shows too, its happening at conferences leads to particularly touchy situations because the women do not want to offend potentially important men in their field and feel obliged to find delicate ways to reject indelicate offers. Because of this, many women act cold to men they meet at conferences, which has the side effect of discouraging friendship with colleagues who could be useful contacts.

A female computer scientist, with experience in several fields, described another problem with being one of the few attendees who needed to bring along their child:

> One difference between biology and computer science that I have noticed is that it is not unusual for childcare to be provided at professional conferences in biology, while I have never seen it offered at AAAI [American Association for Artificial Intelligence], IJCAI [International Joint Conference on Artificial Intelligence], Cog Sci, or ACM [Association for Computing Machinery] conferences. I have a baby that I won't be able to leave overnight for about 2 years (because of breastfeeding), but it is difficult to make daytime childcare arrangements for an out of town conference oneself. Even with an older child, it can be difficult to make the night-time arrangements at home if the child is left behind (traveling spouse, single parent, etc.), so bringing the child along might be preferable if childcare were available.[4]

Additionally, another female computer scientist told me that "some conferences organize 'spouse events' which tend to run to fashion shows, shopping, etc. My husband finds this strangely unappealing!"

Presumably, conference hosts do not mean to discriminate when they fail to provide childcare or provide activities of interest to wives of attendees — I assume that, if the issue crosses their minds, they assume that the number of exceptional attendees would be too small to justify the expense of providing for them. This is an example of how, entirely in the absence of any bad intentions and purely due to the ratio, conditions can be such that a class of attendees cannot conveniently take part in a professional event.

[4] I have been told that childcare was arranged for this year's AAAI.

2.6 Different Priorities

2.6.1 Family Life

Having a support spouse, usually a wife, is a boon for anyone but especially for pre-tenure professors, for whom it is not unheard of to work hundred-hour weeks. Since women rarely have a spouse willing to tend house for them, while male professors and graduate students sometimes do, the women are often at a relative disadvantage. Additionally, wives are often more willing to relocate for their husbands than vice versa [Ferry et al 1982, page 29]. As one computer scientist said:

> There was an article in Chronicles of Higher Education about 3 years ago by a male professor who wrote about how he and his wife (also a professor) needed to have a third party — a wife... The gist of his argument is that faculty workload is based on antiquated notions of unquestioning, full-time support from a spouse, and that universities need to revise their expectations of professors [Frenkel 1990, page 41].

Women in academia have the additional problem that the years in which they must work to get tenure are a significant portion of their child-bearing years. In [Frenkel 1990, page 41], one woman gives this as a reason for choosing industry over academia. Additionally, some women "prefer to take a less demanding job than their qualifications fit them for, because they feel that the time and attention they can afford on top of their responsibilities at home is limited" [Ferry et al 1982, page 30]. This might be one reason that female computer science PhDs are less likely than their male peers to enter academia, more often choosing industry instead.

Not only are some women unwilling to sacrifice family for work, a choice that men rarely have to make, but when women do decide to put their career first, it is still assumed that they do not take their career seriously. According to a survey of (English) female engineers and scientists:

> The most trying moments in almost every woman's life seem to have been spent in interviews. The women in our survey have nearly all taken the trouble to equip themselves with a qualification that might suggest they had ambitions beyond boiling nappies [diapers] and making their husbands' tea. Yet time and again they have found themselves being pulled apart on the subject of whether or not they are likely to leave soon in order to marry or have children [Ferry et al 1982, page 28].

Similarly, a study of the hiring of scientists and technical staff at the National Health Service found that employers often assume

> that all women will leave to have babies and that wastage due to pregnancy is greater than for any other reason. The pervasiveness of [this myth] was shown by the way in which they influenced practices at selection (for instance, only women were asked questions about marital status and dependent children). They also influenced notions of who can be a manager [Homans 1987, page 90].

So even if a woman chooses not to have children or not to take time out to raise them, employers will often assume otherwise and treat her accordingly. Furthermore, pregnancy does not always cause women to miss much work. An army study found that "even when pregnancy leave is included, [enlisted women] take less time off than men, who lose it to sports and auto injuries and drug, alcohol and discipline problems" [McNeil 1991].

Power can be another factor in why women choose not to be professors. The following was written by a woman who had been a professor but had switched to an industrial research position:

> A year ago I would probably have agreed with the popular conclusion that academia is difficult for women because of the time demands, coincidence of tenure with child-rearing, etc. After a little more than a year in industry, I've discovered another reason that academia can be difficult for women. I now believe that to be highly successful in academic research, one has to be very interested (invested?) in having power. Power over grants, over students, over committees, etc. I often heard professors referred to as empire-builders, something that I see very little of where I am now. Often the most successful researchers in my current environment are the ones who actively *avoid* politics and power-struggles and just 'do their work'. As a woman I don't think that I am especially comfortable or adept at the power-games that I witnessed in the university.

Of course, there are also men that dislike power and women who revel in it. Nonetheless, the tendency of women to be less comfortable with power than men may hold in our current society.

2.6.2 The Hacker Culture

Some hacker subcultures have the property that the hackers spend nearly all of their waking hours, and miss sleep, to use the computers. In his discussion of the absence of female hackers, Levy writes: "There were women *programmers* and some of them were good, but none seemed to take hacking as a holy calling the way Greenblatt, Gosper, and the others did" [Levy 1984, page 72].

Another hacker classic, Tracy Kidder's *Soul of a New Machine* describes the intensity of the designers of a new computer:

> Going to work for the Eclipse Group could be a rough way to start out in your profession.... [Y]ou don't have any time to meet women, to help your wife buy furniture for your apartment, or to explore the unfamiliar countryside. You work.... You're working at a place that looks like something psychologists build for testing the fortitude of small animals, and your boss won't even say hello to you.
>
> New and old hands told the same story. Chuck Holland: 'I can hardly say I do anything else now. It takes about three days to get Eagle out of my mind, so if you have a three-day weekend, you're just sorry to see Monday come.' Microkid Betty Shanahan, the group's lone female engineer: 'You can end up staying all night. You can forget to go home and eat dinner. My husband complained that the last three times he's had to do the laundry.' Jon Blau: 'I've had difficulty forming sentences lately. In the middle of a story my mind'll go blank. Pieces of your life get dribbled away. I'm growing up, having all those experiences, and I don't want to shut them out for the sake of Data General or this big project' [Kidder 1982, pages 60–61].

I have been told that, after this book came out, MIT students lined up to interview with Data General, so the described work environment does appeal to some computer science students. In our society, however, women are often less willing or able to devote all of their life to a job, particularly because working full force is often difficult without a support spouse to take care of other parts of one's life.

When reading how intensely and single-mindedly the hackers work with computers, it is hard not to question the people who love the computer to the exclusion of all else, an opinion expressed by the writer of the following letter, written in response to [Markoff 1989], but equally applicable to the environment described in *Hackers* and *The Soul of a New Machine*:

> To the Editor:
>
> You regretfully wonder why women have not done as well at computers as men. You define the issue inside out. The problem is not women's experience with computers but men's. If a 'passionate romance' with the machine is the key to excelling, we should pity the men who do rather than the women who don't.
>
> I am not a feminist crank at either end of that interesting spectrum, but no girl or woman I know is so alienated from her fellows that she 'spurns the real world to master a universe locked inside a computer.'
>
> Machines do seem better suited for use than for passionate romances. So why regret women's attitude toward them? Why not

> worry about yet another generation of men who are sealing themselves off from human contact [Harrigan 1989]?

It is important to remember that women who do not throw themselves into the computer world might not be inferior to men but that sacrificing everything to computers might not be something that a psychologically healthy human being does. Perhaps men and women alike would be better off if some jobs and hacker cultures did not require giving up the rest of their lives.

2.7 Sexual Harassment

Because I take it for granted that readers consider sexual harassment to be offensive and harmful, I am writing little on the subject. It remains, however a serious problem. A recent survey of Harvard students and faculty revealed:

> Thirty-two percent of the tenured female professors, 49 percent of those without tenure, 41 percent of the female graduate students, and 34 percent of the undergraduate women reported having been sexually harassed by a person in authority at least once during their time at Harvard. Fifteen percent of the graduate students and twelve percent of the undergraduates reporting harassment consequently changed their academic plans because of it. Most did not report the incidents [Simeone 1987, page 115–116].

Other studies, such as [Baker 1990] find even higher percentages of women sexually harassed. See also [Gross 1991], an account of the hostile environment for women at Stanford Medical School, which was recently called to attention by the resignation of a female neurosurgeon.

2.8 Summary

Because computer workplaces are often overwhelmingly male, women find themselves in what sometimes feels like a locker room environment, having to put up with behavior they might find offensive, such as sexist or sexual humor and female pin-ups. Additionally, some men use sarcasm or insults to communicate more than women do, causing women to interpret the environment as hostile, even when no offense is meant. Also, because males often have different interests than females do, such as in sports, women may not feel as though they fit in. These factors can cause a woman to feel out of place in a computer workplace and make it difficult for her to picture herself as a computer professional.

Chapter 3

Gender in Language

> *If a woman is swept off a ship into the water, the cry is 'Man overboard!' If she is killed by a hit-and-run driver, the charge is 'manslaughter.' If she is injured on the job, the coverage is 'workmen's compensation.' But if she arrives at a threshold marked 'Men Only,' she knows the admonition is not intended to bar animals or plants or inanimate objects. It is meant for her* — Alma Graham[1]

The Sapir-Whorf hypothesis of linguistics states that the limits of human thought are determined by the nature and the structure of the language in which thought occurs. One corollary, on which this chapter is based, is that the English language's use of gender forces people to think in terms of male and female, with its gender-specific third-person singular pronouns and its different titles, in some cases, for males and females.[2] While it is not necessarily bad to be immediately aware of the sex of someone being discussed, the connotation of male and female terms differ so greatly that the distinction not only implies difference but inequality. Biases in language are important because they show both the biases people hold and how they are communicated.

3.1 Referring to Unknown People

The English language has two sets of pronouns for the third-person singular: he/him/his and she/her/hers. It is practically impossible to talk grammatically about individuals without implicitly mentioning their sex. While this can seem benign, it has several significant implications, which will be examined in this chapter.

[1] Graham, Alma. "How to Make Trouble: The Making of a Nonsexist Dictionary." *Ms.*, December 1973, p. 16.

[2] Of course, many languages are even worse than English [Hofstadter 1986, chapter 7].

When A mentions a person unknown to B ("my biology teacher"), B must find out whether the third person is male or female in order to know how to phrase questions ("How is he/she?"). If A does not provide the information, B will usually guess the default pronoun from what is known — e.g. "he" for a professor, and "she" for a secretary. Most often, this is done subconsciously, showing the speaker's preconceptions. It seems reasonable to expect that when children hear their parents using their best guess for people discussed, they will subconsciously conclude that a man's being a scientist, for example, is normal, while a woman's being a scientist is unusual.

It is common for female scientists to be incorrectly addressed. They tend to consider these incidents humorous, and they trade horror stories:

- One [female] computer scientist with an ambiguous first name wrote:

  > [M]y favorite case in this regard occurred about two years ago, when I received a letter addressed to Mr. [Name], saying 'Dear Mr. [Name]: I attended your presentation at the [A] Conference on [B]. Please send me copies of your related technical reports. Sincerely, Dr. X'
  >
  > Usually, my only response to such incorrect usage is to sign my return letter as Dr. [Name], but that one was too much for me to let slide unremarked. So I sent a reply as follows:
  >
  > Dear Dr. X: While I am accustomed to receiving letters addressed to Mr. [Name] from colleagues who have never met nor seen me, I found your letter quite puzzling. You began by saying you attended my presentation at the [A] Conference on [B]. Surely you must have noticed that I am female! If this was a secretarial error, you might alert your secretary that female computer scientists exist and that in cases of doubt, "Dr." is a genderless form that is unlikely to offend (and may in fact be correct). Sincerely, Dr. [Name].
  >
  > I neither expected nor received a reply, but I felt better, and maybe I saved some other female computer scientist from one of those letters.

- Ironically, when a science magazine ran a survey of its female readers, the female journalists who received the responses found that about half the women had addressed the replies, "Dear Sir" [Ferry et al 1982, page 27].

- A female computer science professor told me:

  > When I was applying for jobs, two of the computer science departments requested letters of recommendation for Mr. [Jane Linda Smith]. One almost immediately sent a followup letter, explaining that they were terribly sorry, that they indeed knew that [Jane Linda Smith] was female, and that they would

certainly read the recommendation letters more carefully than they'd proofread their own request. The other department was the one in which I was then a graduate student.

- When I received an award from the MIT EECS department for the first version of this report, the award letter was addressed to "Mr. Ellen Spertus".

These examples show that some people expect scientists and science writers to be men to such a great degree that they blatantly misaddress female scientists.

Perhaps the most unusual story in this category is that of a woman who was elected to the National Academy of Sciences in the late seventies:

> The scroll that [geneticist] Vivian [Davidson] received from the Academy had her name engraved on it, and then went on to announce that Vivian Davidson was being honored for 'his' accomplishments, and that 'he' was now entitled, and 'he' could, and 'he' should. She was so amazed at all the 'he's that she sent a letter to the Academy inquiring whether the source of the problem might be that the engraver was British and had taken Vivian for a man's name, or was it perhaps that the printing process was lagging behind the process of election of women to the Academy. The letter she received back from the Academy secretary (a man) was an angry one informing her that she was the first person ever to complain, the scroll was an honor, its plate had been struck in 1868 by Abraham Lincoln, and it had a historic value the Academy was not about to tamper with.
>
> At the next Academy meeting in Washington, Vivian raised the matter of the scroll's wording with some of the other women scientists. Each one said she had never noticed the use of 'he' instead of 'she' on the scroll. 'That's probably true,' Vivian said sadly. 'They're so grateful to be allowed into the club, they wouldn't dream of making waves. In all likelihood they *haven't* noticed' [Gornick 1990, page 115].

Also of interest are the experiences of a male professor whose first name is also a woman's name:

> I think having that name has made me more sympathetic to problems women face, as in e-mail it is almost always assumed that I am a women. That means I get a rash of mash notes from the Math/CS students when they first learn e-mail and pick my name out of the user list.... It also means that I get a great response every time I post a computer problem to a usenet group. Since I haven't done the control condition where I have a male's name, I'll never know for sure, but the tone of so many responses are so solicitous that I have

> to wonder (even followups to see if everything worked out okay). The worst case was in a scientific exchange through the mail where the other scientist was being exceedlingly patronizing. It was only when he came to [X] for a convention and tacked on his room and phone number and invited me for a drink that it dawned on me that he thought he was corresponding with a woman. For me I can laugh about these occurrences (as well as the female roommates I routinely get assigned at meetings), but it would certainly be different if it never went away.

3.2 Masculine Terms as Default

3.2.1 The Inequality of Masculine and Feminine Terms

Because male and female pronouns have different connotations, an individual is immediately categorized into a set and assumed to have certain characteristics as soon as their sex is known. The English language forces us to divide people by sex, and, because people have different assumptions depending on whether someone is male or female, preconceptions are applied to them. Were it not for these differences, asking someone's sex would have no greater import than asking how to properly pronounce a person's name, and suggesting that females need female role models would make no more sense than arguing that green-eyed people need green-eyed role models. While there is no reason that specifying the sex of an individual is necessarily bad, it is in a culture where people associate so many characteristics with sex.

When masculine and feminine versions of the same word exist, the connotations often greatly differ:

- A teacher writes of trying to describe one of her brightest students:

  > I found myself saying 'She's really a prince.' Appalled as I was at my own pro-masculine description, I just couldn't say that she was a *princess* because princess connotes someone who is fussy and spoiled and accustomed to living in the lap of luxury [Miller et al 1980, page 58].

- A female computer science student told me:

  > When I was at [X], I derived a good deal of satisfaction from watching my male friends describe my performance in [electrical engineering courses] — 'She's a .....goddess?'

Additionally, "woman" and "man" are not symmetrical:

- As observed in [Hofstadter 1986, page 155]:

> If I write, 'In the nineteenth century, the kings of nonsense were Edward Lear and Lewis Carroll', people will with no trouble get the message that those two men were the best of all nonsense writers at that time. But now consider what happens if I write, 'The queen of twentieth-century nonsense is Gertrude Stein'. The implication is unequivocal: Gertrude Stein is, among *female* writers of nonsense, the best. It leaves completely open her ranking relative to males. She might be way down the list! Now isn't this preposterous? Why is our language so asymmetric? This is hardly chivalry — it is utter condescension.

- One female computer science professor told me:

  > I got a recommendation from a college professor stating that I was 'one of the top female students' in his class (100 students, 10 women, the women were not all at the top of the class, and I *was*).... I'm sure he meant it as a compliment.

- Annie Edson Taylor is described as "the first *person* to go over Niagara Falls in a barrel", while Neil Armstrong is "the first *man* to walk on the moon".

Because masculine and feminine terms have such different connotations, the distinctions make females separate and *unequal*.

3.2.2 Intentional Use of Masculine Terms

Some men consider "being a man" to be high praise even to a woman, and expect her to be flattered at being called one. Here are some examples of women's reactions to being called a man, two from biographies (not of computer scientists) and one in response to my call for data:

- Henry Hazlitt said to Ayn [Rand] one day: 'I just talked with Lu Mises a few days ago. He called you "the most courageous man in America."' 'Did he say *man*?' asked Ayn. 'Yes,' he replied. Ayn was delighted.[3]

- [A] story — which as far as I know, is all it was, — once went the rounds of Israel to the effect that Ben-Gurion described me [Golda Meir] as the 'only man' in his cabinet. What amused me about it was that obviously he (or whoever invented the story) thought that this was the greatest possible compliment that could be paid to a woman. I very much doubt that any man would have been flattered if I had said about him that he was the only woman in the government![4]

[3]Branden, Barbara. *The Passion of Ayn Rand.* New York: Doubleday & Company, Inc., 1986, page 189.

[4]Meir, Golda. *My Life*, New York: Dell Publishing Co., 1976, page 108.

- [This incident] was ... entertaining. I and another undergraduate were head teaching fellows for a computer course and we were working our butts off. He had one final that he was pretty worried about, so I greeted him afterwards with a six pack. His remark, '[Jane], you're such a guy.' — A female graduate student.

In all cases, the original speaker thought he was giving the woman a high compliment. What stands out from these quotes is the different reactions: glee in one case, indignation and amusement in the others. Accepting such compliments is psychologically dangerous because it entails a woman's looking down upon her own sex. For example, Ayn Rand, the only female above to be proud of being "a man", is known for her misogyny, an unhealthy trait for a woman. The same phenomenon occurs among some women in male-dominated careers. One female computer science graduate student used the term "male-identified" to describe women who scorn other women and who aspire to be "one of the guys". Some examples of such statements are:

- A male computer professional wrote:

  > One way [bias is expressed] is the attitude of women themselves. A female programmer here found out that the company next door, run by women, installs PC systems in offices. Her comment was, 'That's pretty good for a couple of women.' Her words, not mine.

- A female computer science student, when one of two female students in a high school advanced placement physics class, said: "I judge how hard a class is by how few females are in it."

While the above comments are shocking, they should be no less shocking than a man's expecting a woman to be flattered by being called a man. In the context of a society which praises women for being "like a man," it is no wonder some women accept the role.[5] [Persing 1978] contains many examples of masculine terms in everyday use.

3.2.3 Unintentional Use of Masculine Terms

Other terms exist besides "being a man" and "one of the guys". A male high school teacher who recognized the sexism in "dividing the men from the boys," told the class that he intentionally replaced the terms with "wimps" and "studs," a usage he did not consider to have gender implications. Indeed, "stud" is now a popular way to compliment someone from work well done. What's ironic is that "stud" is an extremely male word. Its primary definition is a male animal used

[5] I have been able to find nothing in the literature about male identification of women in science, although the phenomenon is widespread. Most women seem to outgrow it and feel ashamed of their former misogyny, but the subject merits deeper study.

for breeding. It is absurd that some consider it a gender-free way to express admiration.[6] When a female professor expressed skepticism that anyone could think "stud" a neutral term, it was called to her attention that a few months earlier, she had told a roomful of female students that they would have to "gird their loins" and get to work. This also derives from male terms.

3.3 Gender-Neutral English

One area currently under debate is gender-neutral English. Above, I discussed the issue of how to discuss a specific unknown person, but it is another question how to discuss a generic person, i.e. with "he" or "he or she", etc. Related to this is whether to use terms like "chairman" and "man-hours" when one does not wish to exclude females.

3.3.1 Background

The most convincing argument that terms like "he" and "man" are not truly neutral comes not from abstract arguments but from empirical research:

> In 1972, two sociologists at Drake University, Joseph Schneider and Sally Hacker, decided to test the hypothesis that *man* is generally understood to embrace *woman*. Some three hundred college students were asked to select from magazines and newspapers a variety of pictures that would appropriately illustrate the different chapters of a sociology textbook being prepared for publication. Half the students were assigned chapter headings like "Social Man", "Industrial Man", and "Political Man". The other half was given different but corresponding headings like "Society", "Industrial Life", and "Political Behavior". Analysis of the pictures selected revealed that in the minds of students of both sexes use of the word *man* evoked, to a statistically significant degree, images of males only — filtering out recognition of women's participation in these major areas of life — whereas the corresponding headings without *man* evoked images of both males and females. In some instances the differences reached magnitudes of 30 to 40 per cent. The authors concluded, 'This is rather convincing evidence that when you use the word *man* generically, people do tend to think male, and tend not to think female ([Miller et al 1980, pages 19–20]).

Additionally, "a number of studies have shown that young people are influenced in their job preferences and their willingness to apply for advertised

[6] There is another whole issue as to what the corresponding female term would be and why none are flattering — i.e. one based on sexual prowess. Brood sow? Whore? Nymphomaniac? This is too far off the subject to explore here.

jobs by gender bias in the wording of the advertisements" ([Bem et al 1973] in [Frank et al 1983, page 90]).

Several sentences can be found that demonstrate that "man" is often unintentionally used to exclude women:

> David Moser once .... observed that in books you will find many sentences in this vein: 'Man has traditionally been a hunter, and he has kept his females close to the hearth, where they could tend his children.'.... So much for the sexual neutrality of the generic 'man'. I began to look for such anomalies, and soon ran across the following gem in a book on sexuality: 'It is unknown in what way Man used to make love, when he was a primitive savage millions of years ago' [Hofstadter 1986, page 145].

Consider also the 10^{th} commandment.[7]

3.3.2 Examples of Usage in Transition

In an approximately one month period of observation, I was able to find many examples of people waffling on the issues of gender nonspecific language at and around the MIT Artificial Intelligence (AI) Lab. I consider ambivalence more revealing than conforming to the old ways, because it shows that many individuals are trying to grapple with the issues but are unable to do so in a consistent manner. These examples are presented not because the behavior was egregious but to show the conflict within individuals:

- A conference was held in one of the most male-dominated areas of computer science. Nevertheless, a few women played prominent technical roles. Relevant incidents were:
    1. A male attendee asked a female speaker: "How many [pause] engineer-years did this take?" His pause was not sarcastic; he evidently decided mid-sentence to use a neutral term instead of "man-years". One guesses he would have used the latter term if asking the question of a male.
    2. A female was introduced as a "chairperson" but, like the other (male) chairpeople, wore a ribbon that said "chairman".
- During a talk, a professor showed a slide which said "he/she" for the generic computer architect, but said "he" when speaking.
- An announcement was sent to members of the AI Lab, containing "I am looking for a few brave men (or women) willing to help..."

[7] It is not entirely fair to put all the blame on the word "man". It is also easy to find sentences such as "People won't give up power. They'll give up anything else first — money, home, wife, children — but not power" [Miller et al 1980, pages 33-34].

- In a recent issue of a journal, a book reviewer referred to the prototypical researcher as "he", parenthetically adding "typically he is a he".[8]

As mentioned above, the trait all these examples share is ambivalence. Many people use neither the old way nor the new way but some mixture. On such melanges, Douglas Hofstadter writes:

> This is not progress, in my opinion. In fact, in some ways, it is retrograde motion, and damages the cause of nonsexist language. The problem is that these people are simultaneously showing that they recognize that "he" is *not* truly generic and yet continuing to use it as if it were. They are thereby, at one and the same time, increasing other people's recognition of the sham of considering "he" as a generic, and yet reinforcing the old convention of using it anyway. It's a bad bind [Hofstadter 1986, page 150].

3.3.3 Reversed-Expectation Writing

Several writers, in order to argue for non-sexist writing, have written essays with other biases than the traditional male/female ones, and the results are (intentionally) shocking. In this section, I describe three such forays.

- Douglas Hofstadter has written an essay ostensibly arguing for traditional usages but from an imaginary standpoint with different terms for whites and blacks analogous to those for men and women in our culture. For instance, "white" is used for "whites and blacks" (as "men" is used for "men and women"), and blacks have different honorifics and pronouns. Here is an excerpt of his (long) essay:

  > Most of the clamor, as you certainly know by now, revolves around the age-old usage of the noun "white" and words built from it, such as *chairwhite*, *mailwhite*,... The negrists claim that using the word "white", either on its own or as a component, to talk about *all* the members of the human species is somehow degrading to blacks and reinforces racism. Therefore the libbers propose that we substitute "person" everywhere where "white" now occurs. Sensitive speakers of our secretary tongue of course find this preposterous. There is great beauty to a phrase such as "All whites are created equal." Our forebosses who framed the Declaration of Independence well understood the poetry of our language. Think how ugly it would be to say "All persons are created equal", or "All whites and blacks are created equal".... [Hofstadter 1986, page 159]

[8]Mackworth, Alan K. "Book Reviews and Response". *Artificial Intelligence*, **38** (1989) 239–251.

- Bobbye Sorrels Persing, in [Persing 1978], has written a powerful essay of an office scene with the male and female roles reversed. Not only are male workers called "boy" and "sir chairwoman" (corresponding to "girl" and "madame chairman"), they are treated and talked about as men stereotypically treat women who work for them [Persing 1978, pages 1–5].
- A recent example exists in the computer world. In *MacTech Quarterly* (now *MacTech Journal*), "she" is used instead of "he" as the generic pronoun. An editorial justified the policy and announced that it would be used henceforth by the magazine [MTQ 1989A].

Further examples of reversing expectations appear in Section 5.1.3.

3.3.4 Reactions to Nontraditional Language

It is telling to look at the reaction to *MacTech Quarterly*'s policy, printed in the issue following the editorial announcement [MTQ 1989B]. A follow-up article wrote that responses poured in, "impassioned on both sides". Some readers canceled their subscriptions, while others pledged to buy as much as possible from the parent organization. One of the most interesting positive letters was from a female novice programmer who wrote:

> [A]s a woman who is a bit intimidated by her love of math and computers, I deeply appreciate being able to open the MacTech Quarterly and have the articles addressed to me, personally, a woman.

Negative letters condemned the (male) editor for abusing his editorial position. One particularly angry writer repeatedly called into question the editor's manhood:

> Ms. Hines,
>
> You seem to be suffering from severe gender confusion. As a private matter, that's fine. Everyone has their foibles. But when it becomes editorial policy it's offensive in the extreme....
>
> When I feel like listening to emasculated male apologists I can always turn on Donahue. He's easy to turn off and I don't have to pay for broadcasting his silly ideas. So unless you will be adopting a more well-thought-out policy, cancel my subscription and send my refund. And I will suggest MTQ adopt the subtitle, "A Magazine for High Tech Women and Eunuchs".
>
> If you've got even a dim memory of when you had balls, you'll print this.

(Note too the use of "balls", i.e. something women do not possess, as a metaphor for fortitude.) The letter illustrates that a man is sometimes considered to be a sell-out for taking a feminist position. (While some men praised the editor for his decision, apparently all of the harshest critics were male.) In addition to the above *ad hominem* letter, there were more carefully-reasoned objections:

1. Because of its long usage as the neutral pronoun, the sex of "he" is much less blatant than that of "she".

2. Using the less grammatical "they" for the singular neutral pronoun is a reasonable choice, particularly as it appears to have been used centuries ago for this purpose.[9]

3. Most of the readers of the magazine are male.

Even in the most carefully-reasoned negative letter, however, the writer expressed his intention not to renew his subscription.[10] This is clearly a point on which people have strong opinions.

In response to my call for information, a man wrote:

> I'm the co-author of the [X] Guide;... One of the decisions that I made was to remove all the sexist language, e.g. "when the user types *his* command" sort of stuff. It wasn't that hard to do, and I figured that it was appropriate.
>
> A couple of the reviewers ... noticed this — I suppose my prose wasn't quite as seamless as I thought it was — and commented on it. They both suggested putting the male gender pronouns back in since "most of the users are men, anyway". I didn't take this suggestion; but what struck me was that these folks actually noticed the *lack* of male pronouns.

3.3.5 Summary

Many people are not sure whether to use traditional or neutral terms. The large number of mixed examples implies that people do not just disagree with each other, but that individuals are unsure how best to express themselves. Additionally, many defenders of male terms do not appeal to tradition or claim that the term is neutral, but they say that the generic person would probably be male. Thus, an empirical rather than theoretical criterion is used, suggesting that the pronoun would change if enough females entered the computer world.

3.4 Summary

The language used in the academic and industrial world, as in much of society, is biased toward male terms. A girl must have a strong vision to see herself in a career considered masculine, and a woman must have strong character not to

[9] See, for example, [Frank et al 1983, page 88] or [Miller et al 1980, pages 121–123].

[10] Of course, these observations are based on the letters the editor chose to print.

be affected by all the masculine assumptions about her. Still, there are some things to be thankful for. As Grace Murray Hopper has pointed out, when the computer industry began, many women worked with computers, so job titles, like "programmer" and "analyst", were gender neutral. That is one barrier less to fight. Additionally, the ambivalence about whether to use gender neutral English and the empirical, as opposed to principled, arguments used by many to support the old way, suggest that changes may be made for the better.

Chapter 4

Problems with Solutions

She never knew whether it was her turn or not, the game was in such confusion — Lewis Carroll, *Alice in Wonderland.*

Unfortunately, many attempts to encourage women in male-dominated fields at least partially backfire. Specifically, special treatment can imply, in a number of ways, that women cannot compete with men. Also, programs implemented to ensure equal opportunity often get misrepresented as having lower standards for select groups. Additionally, consciousness-raising can lead to hypersensitivity and false accusations, which then causes falsely-accused males to be skeptical of women's claims.

4.1 The Perception of Lowered Qualifications

One of the biggest misrepresentations of recent times is that affirmative action is synonymous with lowered standards for favored groups.[1] While some affirmative action programs do involve a deliberate lowering of test scores required for entrance, many programs do not. The goal of many affirmative action programs is to ensure that all applicants are considered in an unbiased manner.

4.1.1 The Need for Affirmative Action

As discussed in Section 1.2.1, women are often judged as less qualified than men when their performance is identical. For example, in one controlled study, department chairs were given nearly identical curricula vitae of supposed male and female applicants and asked to recommend their faculty rank. They chose assistant professor if they thought the applicant was a woman and associate professor if they thought it was a man [Fidell 1975]. The following examples show how these contradictions are rationalized:

[1] I made this mistake in the first version of this report.

- A man is described as 'serving on two departmental committees and *even* on one institutional committee,' while a woman with the identical experience is noted as 'serving on two departmental committees but *only* on one institutional committee [Sandler 1986, page 6].
- A woman who has published only three articles is denied tenure. ('Yes, the articles are high-quality, but she should have published more than that in 5 years.') Later, a man in the same department is awarded tenure. ('Well, he's a slow starter, but he shows a lot of promise.') [Lattin 1984, page 227].

These studies contradict the assumption that, without affirmative action, all decisions are purely merit-based. In fact, few would dispute that "before affirmative action programs were developed, women were routinely turned down for many faculty and most administrative positions, regardless of their credentials" [Lattin 1984, page 228]. For example, "Gerty Cori, the first American woman Nobel Prize winner (for medicine or physiology in 1947) ... was not promoted to full professor until the year she won the prize" [Hunt 1991]. See also [Gornick 1990] and [Selvin 1991, page 28]. Clearly, something is wrong with the way people make decisions, and they must bend over backwards to make sure they consider each candidate equally.

College admissions were also frequently discriminatory before affirmative action:

> The admissions policy of the University of North Carolina, for example, was openly discriminatory [until the early seventies]: 'Admission of women on the freshman level will be restricted to those who are especially well qualified'.... The American Council on Education reported that freshmen who entered four-year colleges in 1968 had widely divergent high school grades: more than 40 percent of the girls had averages of B+ or better but only 18 percent of the boys could boast the same.
>
> The attitude of some male alumni certainly indicates that they would find nothing at all strange in having disparate admission standards: In congressional testimony in 1970, Ann Sutherland Harris reported the following: 'At Yale, when the new women undergraduates protested the quota on women and made the modest demand for fifty more women undergraduates the coming year at an alumni dinner, an alumnus was cheered when he said: "We're all for women, but we can't deny a Yale education to a man."' And when Harris was questioned by Congressman William D. Hathaway of Maine on school admissions policies, the same bias become apparent: 'Mr. Hathaway: If you take the college administration and they have so many kids that they can take into school and they know that 90 percent of the men, for example, in our society have to get a job,

> and, say, only 50 percent of the women are going to get it, and they have a limited number they will take in, aren't they warranted in taking nine out of ten men and fewer girls?' [Abramson 1975, page 74]

With attitudes like this, clearly some sort of program is needed.

4.1.2 Distrust of Qualifications

As mentioned earlier, many people consciously or unconsciously have lower expectations of women. This is exacerbated by affirmative action. If it is suspected (even falsely) that women can get jobs or university positions with lower qualifications, people will be suspicious of their skills. Walter Williams, a black economist opposed to affirmative action, writes about this phenomenon:

> Today's quota policies raise real doubts in the eyes of many whites who wonder whether some blacks have *earned* their status, or whether they had it handed to them. Like sickle cell anemia, this 'How do you know?' problem has become a sort of black man's disease.
>
> It's not exclusively a black man's disease, however. Women and others who have been given special treatment also are victimized by it. Recently, I had the occasion to take a short commuter flight. Upon boarding the aircraft, I saw a woman sitting in the right hand side of the pilot's compartment. There I was, faced with the 'How do you know' problem, with pretty high stakes in the balance.[2]

The recent press coverage of Supreme Court nominee Clarence Thomas shows how unreasonable people can be about quota programs. Newspaper after newspaper reported that, because Holy Cross College and Yale Law School had aggressive minority quotas when Thomas was admitted, he necessarily "benefitted from minority preference admissions policies".[3] The implicit assumption is that, if a quota system was in effect, *none* of the admitted blacks were qualified. While some of the blacks may have been unqualified, it would be ridiculous to assert that none were, and, specifically, that Thomas was unqualified. Additionally, as just discussed, Yale's pre-quota admissions did not even purport to be purely merit based.

[2] Williams, Walter E. *All it Takes is Guts: A Minority View.* Washington, D.C.: Regnery Gateway, 1987, page 44.

[3] Barrett, Paul M. and Stephen Wermiel, "Judge Thomas, Billed as Conservative, May Prove Unpredictable," *The Wall Street Journal*, July 19, 1991, page A1. The same fallacy appeared in *The New York Times* and *The Chicago Tribune*.

4.1.3 Low Self-Confidence

When women suspect (even falsely) that they have gained something through affirmative action, their self-confidence often suffers. One female MIT student wrote:

> As a freshman I was told I got into MIT because I was female. When I was a sophomore, people told me I would get into 6-A [the industry co-op program] easier because I was female. When I applied for permanent jobs, I was told companies would hire me just because I was female [Anu 1990].

As noted in [Anu 1990], hearing such statements repeatedly can harm a woman's self-esteem and cause her to question her ability.

No feminist I have spoken with has favored admitting less-qualified women to university positions. It is easy to see that, in addition to breeding the distrust described above, admitting unqualified women would, in general, be harmful to the people one wants to help: If a woman is admitted to a school for which she is not qualified, she will probably be less happy and successful than if she attends an institute for which she is qualified.

4.1.4 Uncritical Faith in Test Scores

Another point of confusion in the affirmative action debate is how much weight to put on objective test scores.[4] While many people assume that someone with lower SAT, LSAT, etc., scores is less qualified, this is not necessarily the case:

> The SAT is marketed as a predictor of first-year college grades. Yet women, who earn higher first-year grades than men, score lower on the SAT math and verbal section....
>
> Moreover, women perform as well as, if not better than, men on New York State's Regents exams for algebra, geometry and trigonometry. Yet women consistently score lower than men on the SAT math section. The manufacturers have no explanation why women score lower than men on the SAT verbal section. It is well known that females perform better than males in high school English classes [Horner et al 1990].

For example, statistical analysis done at MIT shows that although male undergraduates have higher average board scores than female undergraduates, women graduate at a higher rate than men and receive grades that are just as high, even when adjusted for major.

[4] I've always found it ridiculous that the person with the highest recorded IQ claims to be the smartest person in the world.

4.1.5 Conclusion

While there is a need for affirmative action programs, they have large negative effects that must be considered. Even if a program does not entail lower standards for women, doubts are cast on a woman's qualifications in a society that already mistrusts them. Programs with lower qualifications may be a tactical mistake (in addition to being unjust) because people may be put in situations for which they are not qualified, giving them less overall success and self-confidence than they would have had otherwise. These negative effects should be weighed when considering implementing an affirmative action program.

As phrased in [Ernest 1976, page 607]:

> We strongly support such affirmative action to ensure that all potential female candidates are considered. Such increased recruitment efforts can only enlarge the list of qualified candidates and thus result in the *raising* of standards. To immediately dispose of a red herring, let us state emphatically that none of us believe a *less* qualified [scientist] should be hired, just because she is female.

4.2 Informal Special Treatment Harmful

Not only can institutionalized special treatment be harmful, but so can individual initiative. Many instances exist of mixed attempts to encourage women:

- A female professor taught an electrical engineering course and announced that she especially wanted the women in the class to do well. During tests, she went around to the few women in the class and would try to help them. The female student I talked to said this behavior made her very uncomfortable, and she felt that the men in the class resented it.
- A female computer science graduate student had these experiences:

  > My undergraduate advisor consistently encouraged me to go on to graduate school, to apply for scholarships and fellowships, and basically gave me a strong consistent message that I was good at this stuff....[While I have had many bad experiences,] I have had a number of friends, bosses, advisors, over the years who have been very supportive, some seeming to disregard my gender, others aware of it and patting themselves on the back for being so good about recognizing my talent anyway. The classic example of this is the well-meaning professor who asks every woman student he has opportunity to talk with, about whatever topic, 'How are things here for you as a woman?'

- When a female computer science student visited a top graduate school to which she had been admitted, she told me that a male graduate student presented each of the women with a rose and told each that he wanted her to come to that school. When I heard this story, I asked a female graduate student in the department whether this student was trying to sabotage female recruitment. She answered:

> It turns out a bunch of people who were doing a lot of work on organizing the recruiting weekend had decided, off the cuff, that they thought this could be nice (as in: what should we do with the leftover roses). So it wasn't this one grad student working on his own, and it was not an attempt to sabotage recruiting.
>
> Its effect, however, was slimy and sabotaging. As you note. Some of the women decided it was the one unsocialized nerd, others thought it was strange but disregarded it, and others realized fully how totally inappropriate it was even as the rose presentation was happening. One of these let the deliverer know, too, what she thought of it.

All these cases have in common that women are conscious of being treated differently from men by someone who is trying to encourage women. Most women do not like this sort of treatment, although they are grateful for encouragement when it is sincerely offered. Nevertheless, it would also be wrong to suggest that professors not encourage women if it does not come naturally to them and that computer professionals should be as obnoxious to women as they often are to men. Additionally, people disagree on when special treatment is positive and when it is negative. For example, one woman objected to there being a class entitled "Women and Computers":

> I think the class is very poorly named, and I for one would *not* sign up for such a course. It assumes that women have different/special issues with regard to computers than men have, solely because of their gender. This gives exactly the wrong message to both men and the more 'traditional' women. What we as liberated women *should* be doing is asserting over and over until we can make it so that, except for a few basic physical differences that we unfortunately can't deny (e.g., size and upper body strength), *women and men are the same.* By naming a course 'Women and Computers,' all you are doing is helping to perpetuate the myth that women are somehow 'different' and should be treated differently. That's how we got where we are in the first place![5]

This behavior is closely related to condescension, a problem described in [MIT 1983, page 9], from which the following quotations are taken:

[5] Bond, Patricia. Comp.society, April 20, 1990.

- "Often, when I ask a male graduate student how to do some task, particularly something on the system, he will do it for me rather than explain to me how I can do it for myself."

- "I asked a male graduate student a technical question and got an answer that seemed to be aimed at someone with little or no knowledge of computer science, as if it were being explained to a high school student rather than a colleague."

Thus, in attempting to help women, people sometimes end up implicitly insulting them.

4.3 Special Awards for Women

4.3.1 Separate Categories for Males and Females

Some people propose female-only competitions as a way to benefit women. However, the psychological effects of such contests are sometimes negative.[6] One female undergraduate wrote:

> I [disagree] with the suggestion that they have different contests for boys and girls. I believe this has a negative effect. My high school was big on "top boy" and "top girl". I think it is from traditions like that I got the idea (now mostly eradicated) that I would be smarter if I were male. Until recently, I couldn't stand not being the top girl in a category (i.e., being beaten by a girl), but I didn't mind a guy's beating me. The award categories seem to imply that females can't compete with males. Wouldn't people find having separate competitions for whites and blacks offensive, particularly if the blacks weren't allowed to enter the white contest?

It should be mentioned, however, that some women believe that the contests are worthwhile by providing rewards and encouragement to highly-achieving females. Thus, no consensus can be said to exist on the issue.

4.3.2 Fellowships for Women

One popular way of encouraging female graduate students is through special fellowships for women. Again, the opinions are divided on the psychological effects. On the negative side, the same student who complained about female-only contests wrote:

[6] The quotations from this section are largely taken (with permission) from a discussion within a large electronic mailing list of women in computer science.

> I am a senior, applying to graduate programs in computer science, and was just offered a fellowship from [X]. At first, I was very pleased and proud (called my parents, went out to celebrate), but then I went back to my fellowship application material and saw that certain fellowships are awarded particularly to women and minorities in fields in which they are most underrepresented. (I can't tell if my fellowship is in this category. I will try to find out.) While I can understand how such awards might be good for women who were very worried about costs, the offer has left me feeling more bad than good. For a few hours, I was thinking of myself as the best of the best — i.e. as having won the fellowship on merit — but now I feel like I wasn't allowed to play in the big league.
>
> In contrast, I was offered a RA [stipend and tuition waiver in exchange for research] next year by my bachelor's thesis supervisor. That made me feel great. If I thought the offer were related to my being female, I would have rejected it.

She reported that a male friend of hers said:

> I'm glad I'm not in a similar position — you know I'm trying to improve my self-confidence, and I'd feel so unsure in a world that wouldn't tell me whether I was good or just the recipient of a less-deserved award.

Another female graduate student wrote:

> I don't want anyone ever to think that I got where I am because of special favors granted to me because I'm female. I decided ... that I would not apply for any fellowships or special programs for women. I [don't want people to] think that I don't have to work as hard as a man to succeed in my chosen career.

The majority of women who expressed an opinion, however, supported special fellowships and urged women to accept them. One female computer science professor wrote:

> While I was a graduate student at [X], I got a fellowship that was earmarked for women. Initially I felt ... that while I was glad to get the fellowship, ... it was second class in some way. Two things have changed my mind on this. First, I found out that my fellowship was in fact harder to get because it was a national contest rather than a intra-university contest. This solved my initial problem with respect to the particular fellowship.
>
> The second thing completely changed my attitude about what it takes to be successful. Now that I am faculty, I realize how hard it is to raise money. I now actively search for sources of funding that

> are slightly unique to me: funding for women, funding for first year faculty and so forth. And why not? Others look for funding that is particular to VLSI say.... [W]e are judged on our output, and ... we should take advantage of any opportunity that comes our way. That initial ... fellowship has caused doors to open for me all along my career — job offers, research funding, etc. In hindsight I would have been an idiot to decline it.
>
> I now realize that my initial feelings about the fellowship said more about my attitude toward women than reality. That fellowship wasn't second class, I just thought something special for women must be. I've been taught an important lesson.

Many people do not realize how competitive some fellowships for women and minorities are. The competition for the top women and minorities fellowships is now so intense that a female computer science student I spoke with was not surprised when she failed to win a special fellowship for women but won the most coveted fellowship that was open to both sexes. Because outside funding makes graduate life easier and because any stigma associated with special fellowships seems to be decreasing, they are almost certainly a worthwhile way to help women further their education.

Another issue is whether such programs are morally justified. There would be an outcry against a publicly-funded scholarship for which only men were eligible, so a women-only scholarship program might not be morally justifiable. On the other hand, as this report has documented, women face so many biases that there is reason to believe that practically all women are unfairly handicapped in some way relative to men. Different people will have different opinions on whether a biased program is a legitimate response to existing bias in a community.

4.3.3 "Heck, We Want More Girls"

Perhaps the most insidious form of sexism is practiced by men who are eager for more women to enter computer science, but for social reasons. The following quotations from female graduate students are from [MIT 1983, pages 14–15]:

- "A male graduate student said, 'The problem with this place is that there aren't enough attractive, available female graduate students.' Enough for what? I'm not here to be available and attractive."
- "A graduate student said, 'Men are tired of only seeing men. They want to see women in dresses, not women who look like men.'"

More recently, in a public discussion on women in computer science, an ostensibly sympathetic male wrote, "Sigh. I'd love to see more girls [sic] as my classmates!" The "sic" was added by the moderator of the newsgroup (who can edit messages before they are posted), in protest of using that term for college-aged females. This sort of message is not uncommon. In another discussion, a man wrote:

> At the time, we were *really* trying to hire some females into the software side and I was interviewing a bunch of new grads — mostly girls. There was this girl whose resume looked good and since she was as they say — easy on the eyes, I was trying hard to find reasons to hire her.[7]

Such examples occur not only in informal exchange but also in published books. On several occasions, in *The Psychology of Computer Programming*, Gerald Weinberg expresses opposition to sexism, decrying prejudice (page 98) and scoffing men who initially fail to take women seriously (pages 147–148). The chivalry of his appeal, however, undermines his point:

> Each prejudice has its price. In a programming project, the exclusion of anyone from any position on any basis besides lack of competence robs the project of the best possible performance. Moreover, once one faction begins to feel that they are being judged differently from others, they will begin to act differently.... Possibly the greatest single action to relieve the shortage of programming and programming management talent would be to start treating women as true equals — if indeed they are only that (page 112).

Additionally, at another point in the book, he refers to a female employee as "an attractive young thing" (page 48). Most women would probably consider themselves better off without allies like this.

4.4 Bad Consequences of Raising Consciousness

While consciousness-raising is beneficial overall, it has several negative effects. After hearing how other women have been mistreated, women sometimes become hypersensitive, particularly because they do not necessarily know which person made which egregious statement that they have heard third-hand. Men, too, also can become unnecessarily inhibited in their actions with females, and being the victim of hypersensitivity could cause them to be suspicious of just complaints.

4.4.1 Female Hypersensitivity

One consequence of increasing awareness of sexism is that women may then expect it and treat men with more suspicion. For example, at MIT, there

[7] Chow, Stanley T. H. Article 17986 of alt.folklore.computers, date unknown.

were many cases of men misinterpreting women's friendliness as expressions of romantic interest [MIT 1983, page 14]. While women should know that their behavior could be misinterpreted, such knowledge has negative effects as well:

> Some women react by becoming wary of all new men they meet. Thus, some men are confronted with negative reactions from women to seemingly innocuous, friendly overtures [MIT 1983, page 4].

Men who have been overreacted to are likely to, on the basis of a misinterpreted event, treat women's complaints with skepticism.

This phenomenon is also illustrated by the following letter from a male computer science student:

> First, let nothing I say leave you with the impression that I don't believe sexism or racism exists. However, I think that many incidents are incorrectly interpreted.
>
> I am TAing the introduction to AI this semester. After I graded and returned the first assignment some woman and her boyfriend questioned me about the grading. Her grade was somewhat below his (about 5 out of 30 points I think). Her homework was one of the sloppiest ones in the class, and probably deserved a lower score but I had been instructed to grade generously for the first assignment. Among her arguments was something about how hard she had worked on it (there was no evidence of hard work). And something about how she and her boyfriend had done it together. Ignoring the possibility that this was cheating (cooperation was not allowed) I felt that there was some implication that she felt I was giving her a low grade because of her gender....
>
> Since then I have talked to her several times. At first I think she may have worried that my grading was gender biased, but I don't think she now believes that.
>
> By the way, I did a very rough check of my grading records some time ago. By sorting the class by average grade and eyeballing the result I think that about $\frac{1}{3}$ of the women are in each of the top, middle, and bottom thirds of the class.

Also, there have been cases where women have gotten upset at unwanted physical contact, such as being patted on the back by a man, before finding out that he treats both men and women in that manner. (Of course, there are many more cases where men only try to touch their female colleagues.)

Because of consciousness of discrimination, sometimes people who are "obnoxious to everyone" get falsely accused of sexism or racism. For example,

> 'General' harassment often takes a specifically sexist form when applied to women.... Instead of saying to some average white male, *'Your work on this project has been inexcusably sloppy, you blinking*

> *idiot; you'll never make it that way!'*, the remark may come out, *'My God, you think no better than my wife; why don't you go home and have babies!'* [Rowe 1990, page 159]

Additionally, reports and anecdotes are filled with anonymous examples of sexist statements by male professors, staff, and students. After hearing such things, a female student has no idea which people around her hold such disturbing attitudes and is likely to distribute her distrust among the guilty and innocent alike.

4.4.2 Male Hypersensitivity

After men are made aware that women are unhappy with receiving unwanted and improper attention from male colleagues, there is the risk that they will be hesitant to socialize with females. This phenomenon followed the distribution of the MIT report on discrimination [MIT 1983, page 19]. Because informal interaction is an important part of the educational process, this represents a serious loss. For example, it is not uncommon for professors to have meals with their students. It would be a shame if they failed to invite their female students, out of fear of being misunderstood.

Hypersensitivity on both sides occasionally escalates an innocent incident into a colossal misunderstanding. When "Jane" was interviewed for a job by "John", she found the interview style strange. John spent almost all the time talking about the company and appeared uninterested in hearing Jane say anything about herself. Jane mentioned she thought this style odd. Later, she spoke to a friend "Mark" who had worked at the company and was friends with John. He said that John had said that Jane was suspicious at the interview and seemed to think that she was being interviewed purely for quotas — i.e. that they were not interested in her qualifications. This idea had never crossed Jane's mind — until that point. After Mark made some further statements about how the company's leaders were opposed to affirmative action, Jane decided it was likely that the reason she had not been asked many questions was because they did not want to hire a female. She felt confident of this conclusion when they offered a job to a male whom she considered to be of equal skill to herself. A few days later, however, they invited her for a plant visit and offered her a job. Thus, both John and Jane incorrectly leapt to conclusions.

4.5 Summary

Even when people genuinely want to encourage women in computer science, their plans sometimes backfire or have mixed effects. Good intentions do not always lead to good results. This is emphatically not an argument against working to help women; rather, I mean to alert people to carefully consider the consequences of their plans and to work to minimize any negative effects. My recommendations for effective behavior are in the next chapter.

Chapter 5

Recommendations and Conclusions

> *A taste for the abstract sciences in general and above all the mysteries of numbers is excessively rare; one is not astonished at it; the enchanting charms of this sublime science reveal themselves only to those who have the courage to go deeply into it. But when a person of the sex which, according to our customs and prejudices, must encounter infinitely more difficulties than men to familiarize herself with these thorny researches, succeeds nevertheless in surmounting these obstacles and penetrating the most obscure parts of them, then without doubt she must have the noblest courage, quite extraordinary talents and a superior genius* — Gauss to mathematician Sophie Germain.[1]

> *As the data from women's career studies and anecdotes from personal experiences of women professionals begin to accrue, one of the questions that arises is not 'Why are there so few successful professional women?', but rather, 'How have so many been able to survive the vicissitudes on each rung of the career ladder?'* — Dorothy Zinberg[2]

There are a large number of factors that discourage women from becoming computer scientists and computer professionals. From early childhood, females are treated differently from males, and, to become computer scientists, they often have to face problems that males do not have to deal with. In this chapter,

[1]Bell, Eric Temple. "The Prince of Mathematicians", James R. Newman, ed., *The World of Mathematics.* New York: Simon & Schuster, 1956, volume I, page 333.

[2]Kundsin, Ruth B., editor. *Women and Success: The Anatomy of Achievement.* New York: William Morrow & Company, 1974, page 129.

I suggest how people can work to counteract these effects. Because this chapter is based so heavily on material earlier in the report, I recommend that earlier chapters be read first.

5.1 Recommendations

The recommendations are divided into four categories: programs that could encourage women in technical fields, ways for women to build their self-image as scientists, ways for women to deal with biased behavior, and suggestions for men and women who wish to encourage women in the sciences.

5.1.1 Programs and Policies to Encourage Women

Programs that could be implemented to encourage women are discussed by [Keith et al 1990, Leveson 1989, Sandler 1986], and interested readers are urged to read the full suggestions in these documents. Many of the following suggestions are from these sources. While the suggestions are geared to universities, most can be adapted to industry as well. Recommended actions are:

- *Making clear that sexual harassment will not be tolerated.* Individuals in supervisory positions, such as professors or managers, should make it clear that they will not tolerate sexual harassment. Not only would this discourage such behavior, but harassed females presumably would feel more comfortable reporting any problems that do occur to supervisors who have made it clear that they are aware of the possibility of sexual harassment and want to fight it. One way an EECS department head did this was by announcing during a graduate orientation session that sexual harassment was unacceptable and that any harassment victims or witnesses should alert someone in a position of authority. See [Rowe 1981, Rowe 1985] for advice on implementing effective programs to fight sexual harassment.

- *Educating all members of the academic community — including board members, administrators, faculty, students, and staff — about professional climate issues; the various forms differential treatment takes; and the institution's commitment to ensure equitable treatment* [Sandler 1986, page 17]. One way many schools do this is by teaching about subconscious discrimination when training graduate students to be TAs.

- *Establishing a dialogue with women in the department to make sure their concerns are being communicated and addressed.* Many women have given thought to how their department could be improved but are never asked.

- *Regularly gathering data by sex, race, and age* covering areas such as salary, benefits, promotional analyses, special perquisites, awards, grants, courseload, advising load, committee assignments, and so on to determine if men and women at all ranks and within all units are treated equitably with regard to responsibilities and rewards [Sandler 1986, page 18].

- *Making equitable treatment of women and minorities part of the formal reward structure.* For example, when evaluating performance, give commendations to individuals and extra positions to departments that excel in this area [Sandler 1986, page 19].
- *Providing a method for individuals to turn off the tenure clock so they can have children without sacrificing their career.*
- *Providing opportunities for professors to serve as mentors to students or for graduate students to mentor undergraduates.*
- *Making sure that female students are involved in research.* Much of the information about research opportunities, particularly at the undergraduate level, is communicated informally, and some students may be left out. Additionally, if pre-college experience is a prerequisite for undergraduate research, women and minorities, who tend to enter with less experience, may fall further behind. This could be avoided by informing students what knowledge is needed for interesting jobs and encouraging them to take such classes early, or by setting aside money for research groups that are willing to provide training.

5.1.2 Ways for Women to Build Self Image

As described throughout this report, being a woman in computer science is unusual in that the majority of one's peers are male and many people, consciously or subconsciously, expect the men to perform better. These expectations are subtly communicated to both males and females. Fortunately, there are many ways that a woman can increase her self-confidence and her self-image as a computer scientist.

Attending Classes with Other Women

A female computer science student often find herself in a classes where she is one of the only women. Additionally, she is likely to have few, if any, female professors. Even in the absence of being treated differently, this is likely to affect a student's self-image and perceptions of women. In reality, females in coed classrooms are usually treated differently from the males:

> [T]eachers praise boys more than girls, give boys more academic help and are more likely to accept boys' comments during classroom discussions... While girls sit patiently with their hands raised, boys literally grab teacher attention. They are eight times more likely than

> girls to call out answers ([Sadker et al 1985] in [Van Nostrand 1990, page 187]).

(See also Section 1.2.1.) By taking classes at women's colleges or in women's studies, which almost always have a large majority of women, female students feel free to more actively participate in the classroom and are taken more seriously by teachers and other students. While advising technical females to consider single-sex high schools and colleges may appear counter-intuitive, particularly because these schools often have less adequate laboratory facilities, studies have shown that females at single-sex schools study more science and mathematics than those in coeducational schools [Kelly 1982, page 499], are more likely to continue in science [Ferry et al 1982, page 27], and are disproportionately successful compared to other women [Gilbert et al 1983].

Another advantage of women's studies programs is their emphasis on women's achievements. One female computer science student had the following experience:

> When I entered my first women's studies class, on literature written by women, I expected to encounter second-rate works that were only being taught when the ground rules eliminated male competition. Instead, the books were first-rate, and I wondered why I had never read them before. The class taught me that women's achievements had often been overlooked. (I had been pretty misogynic before that.)

Because of men's numerical and figurative dominance in engineering classes, a student in a women's studies course can find herself listening to vocal female students for almost the first time since entering college.

Another benefit of women's studies programs is that they document the barriers women have faced. It is important for women to realize that the paucity of women in the field does not imply that women are inherently unable and that negative behavior they encounter may be due to their sex and not to any actual shortcomings on their parts.

Female Role Models

Finding female role models and mentors can also be helpful to a woman's self-image. While male mentors are certainly useful, and many women are happy with male advisors, female role models serve the additional purpose of providing a living example of a successful female scientist. One study found that "[f]emale graduate students who identified female professors as role models viewed themselves as more career oriented, confident, and instrumental than did female students identifying male role models" [Gilbert et al 1983, page 597], although, as the report notes, self-selection may also have been a factor [Gilbert et al 1983, page 605]. As noted in [Leveson 1989, page 20]:

> The importance of mentoring and role models cannot be stressed too much. One female student ... wrote about her experience in a summer job working for a female manager who she described as: 'one of the most respected people in the company. I had never expected that having a female role model would change the way I felt about myself, but it did'.

Thus, a female student should consider finding a senior woman in her field to work for at school or during a summer job. While a person's sex should not be the primary factor in choosing a mentor, spending some time with a female role model can be psychologically beneficial. (See also [Simeone 1987, pages 104–109].)

Women's Groups

In part because female computer science students so outnumber female professors, one-to-one contact is not always possible. Many schools have get-togethers for women in computer science or engineering, ranging from informal annual meetings to regular meetings of the Society of Women Engineers. Women find these activities useful for receiving encouragement and advice, and they "generate a lot of good feeling" [Leveson 1989, page 23].

Perhaps the most effective group currently existing for women in computer science is an electronic mail discussion group with over seven hundred members which provides women with a "forum for discussion of both the problems and joys of women in our field and a medium for networking and mentoring" [Frenkel 1990, page 36]. Women share advice on female-specific topics such as the best time in one's career to have children, how to dress for conferences, and how to deal with sexism, as well as general-purpose networking. The list is particularly important to women in computer science because they are so dispersed and might not otherwise be able to interact with many other female computer scientists and engineers. Being part of a discussion group with hundreds of female computer scientists can change a woman's default image of a computer scientist from male to female (or neutral) — quite a difference from a student's academic experience, where two thirds of the computer science departments have zero or one female professors [Gries et al 1991].

5.1.3 Ways for Women to React to Biased Behavior

In cases of blatant sexual harassment, a woman can usually complain to some authority. In less clear-cut but nevertheless offensive situations, this option is often not open. While acting as a group and writing a report was effective for women at MIT [MIT 1983] and Carnegie-Mellon [CMU 1989], often women must react individually to behavior they find unacceptable.

Reacting to Subtle Discrimination

As discussed in Section 1.2.1, women are often the victims of subtle subconscious bias. For example, a woman may find that comments are primarily directed to men in a group, unintentionally leaving her out. If the woman does not feel comfortable directly confronting the individuals in question, there are more diplomatic methods of calling the behavior to the person's attention:

- In a meeting of three computer science students, the sole female found herself ignored by one of the male participants. Whenever she asked him a question, he directed his answer to the other male present. (See page 12 of this report.) After the meeting, the woman took him aside and mentioned that she had noticed he had directed his answers to [John] and asked, in a concerned way, whether she had done anything to cause this behavior. When he replied that she had not done anything wrong and began to apologize, she dismissed his apologies by saying that she was just relieved she had not given him any negative signals. He continued to apologize.

  The indirectness of her approach allowed the man to save face while still communicating the point. It appears to have been effective, because, when she saw the man later in the day, he made eye contact and spoke directly to her.

- At a social occasion, a young woman found that a male relative directed serious discourse almost exclusively to her brother and not to her. When the woman was alone with the relative, she said to him, 'I hope I haven't given you the idea I'm not interested in your opinions on [X]. I noticed you directed your comments about it to [John]. I want you to know I am interested in what you have to say on the subject.' The male relative replied, sincerely, that he had not realized she was interested in the topic and would include her in the future.

While some people might object to these oblique methods, as they involve the victim's pretending to put the blame on herself, they are effective in situations where the woman does not feel comfortable being more direct, and they often elicit an apology.

Reacting to Overtly Sexist Comments

Indirect methods are also often more effective than direct means for dealing with offensive sexist and sexual comments. As mentioned in Section 2.2.2, the only consequence of complaining is often that one is dismissed as a 'feminist'. In a recent column in *The New York Times*, a woman described her experience as a college journalist:

> Though I was militantly middle of the road in perspective, by the second time I mentioned sexism in print I was pegged. People I met seemed to treat me like a Marxist, a radical, a testosterone-fueled male-basher; others asked me why I suddenly hated men so much; and certain folks at home warned me that I was going to jeopardize my future by scaring off potential male suitors [Kamen 1990].

Two techniques that are often more effective than anger (even when justified) are role reversal, which involves the substitution of other terms for female terms, and humor. Combinations of these two techniques are especially effective.

Role Reversal Treating men in the manner in which they treat women can be an effective response to poor treatment:

- One female computer scientist said:

  > I'm much more often complimented for my dress, my hair, or my accent than for the content of what I say and do. So I just turn the compliments around and tell men how pretty their ties are, or how the cut of their jackets bring out their broad shoulders. They squirm under such scrutiny just as we do [Frenkel 1990, page 41].

- When a group of men were unable to understand why women in the workplace were offended by posters of naked women, a woman put up a huge picture of a naked man. She was asked to take it down, communicating her point.[3]

Substituting terms pertaining to race instead of sex can also be effective:

- Someone who does not understand why it is offensive to call a grown woman "girl" should be asked whether they would call an adult black male "boy", something that also used to be considered acceptable.

- A female computer scientist related the following story:

  > [A few years ago,] I wrote to Time Magazine to register my opinion about a 'humor' piece titled 'Women Are Getting Out of Hand', which included lines like 'Women are getting too big for their britches'. I suggested that they would not be likely to publish articles like 'Blacks Are Getting Out of Hand' or sentences like 'Hispanics are getting too big for their britches'.

See also the passages in Section 3.3.3, which, while impractical for conversation, also make the point.

[3] Actually, the reason she was asked to take it down was because a nearby man was afraid he would be suspected of being homosexual.

Humor Humor is effective for several reasons. First, when men make offensive remarks, if someone protests, they retort: "Can't you take a joke?" When a woman uses humor to protest an offensive remark, she can offer the same response if challenged. Additionally, humor breaks tension and often allows one to point out that something is wrong without a direct confrontation.

One female computer professional told the following stories:

- Shortly after my appointment, my boss, V.P. of Administration, called a meeting to discuss the problems of the center. All of the attendees were male and deans or equivalent high positions. The discussion in that meeting was quite heated with adamant remarks about the problems in computing on campus. Towards the end of the meeting, one of the attendees started pounding on the table and reviewed the names of the previous male directors of the center, ending with the comment, 'No offense meant, [Jane], but we need a man in this job.' I responded with, 'I'm willing to do almost anything to fix the problems in the Computer Center, but a sex change operation is out of the question.'

  That turned out to be the perfect response — I got my point across and it broke the tension with laughter. The moral of this story is, that if you can make your point with humor, the message goes down easier.

- Another time, I received in the mail an advertisement from a company that sells disk drives. The advertisement was included in a box that contained Havana cigars. (Obviously, this company assumed that the mailing list they had of CIO's were all men). I wrote a letter to the VP of marketing for the company telling him that I thought that one of his competitors were trying to undermine the intelligence of his marketing organization by sending cigars to female decision makers in his company's name. Two days later, I received a federal express delivery from him — it was a bottle of perfume with a letter of apology. I thought his response was a good recovery.

A computer science professor told the following story:

> [W]hen I first starting teaching 13 years ago, I was married at the time and both my husband and I had teaching positions in the same department. My department head was sitting in my class (at the time we were in a joint math and CS department and my department head was retraining). [O]ne day, one of my students referred to me as Mrs. [Smith] in class and I was feeling pretty frustrated by that point since I had noticed that I kept getting called 'Mrs.' while my husband was [called] 'Dr.', so I looked at him and said 'What do you call Karl?,' and he replied 'Dr. [Smith]'. So I told him that I'd appreciate it if he would use the same title for me since I had the same degree. Well, he wasn't the type to quiet down quickly, so he

retorted, 'And what does Karl think of your feeling that way?,' to which I replied angrily, 'It doesn't matter what he thinks; it was a helluva lot harder to get a Ph.D. than it was to get married.' Word apparently got out to the students after that because I wasn't called 'Mrs.' for quite some time. (Of course, I was shaking by the time class ended wondering what my department head thought of that reaction. He never did say anything about it.)

Female computer scientists have combined the techniques, role reversal and humor, as in the following incidents:

- A female computer scientist reported:

    A few years ago I was at a workshop held way out in the country.... There were about forty people there. I don't remember how many were women, but there couldn't have been many.

    At one point we were sitting around singing, and after a while someone started one of those make-up-a-verse of your own affairs.... It went around for a while, and someone offered,

    I know a girl, her name is Jill.
    dum-de-dum de dum-dum-dum-dum
    She won't do it, but her sister will.
    dum-de-dum de dum-dum-dum-dum

    Well, I can't carry a tune in a bucket, but I co-opted the next verse:

    I know a guy, his name is Bill.
    dum-de-dum de dum-dum-dum-dum
    He won't do it, but his brother will.
    dum-de-dum de dum-dum-dum-dum

    Everyone laughed, and I thought the matter was settled. But some people won't give up, and a few rounds later, the *same* fellow came around with:

    I know a girl, her name is Sue.
    dum-de-dum de dum-dum-dum-dum
    She won't do it for me, but she'll do it for you.
    dum-de-dum de dum-dum-dum-dum

    Drat! Can't back down now ... I got as far as:

    I know a guy, his name is Lou....

    when the *rest* of my colleagues shouted down the offender.

- A female computer science graduate student reported the following incident:

> A [campus] career recruitment poster, several years ago ... made quite a splash. The poster portrayed two men in shirts and ties picking up a printout off a line printer, dropping the fanfold paper all over the floor as they ogled at a woman walking by in a miniskirt. The caption: 'We think about more than just work here at [Company Name].' Outraged women began tearing the posters off the walls, then (insert light bulb here) they instead made photocopies and put them up in great numbers all over campus. Meanwhile, the recruiters figured out something was wrong and tried desperately to get rid of them. A number of women went to the recruitment talk to disrupt it, and found that they were the only ones there. Several hack posters were created, for example one with two women in businesslike garb poring over a printout while a scantily clad beach-boy type walked by, with the caption, 'We think about more than just sex here at [Company Name].' I believe the president of the company issued a formal apology afterward. This one is notable as much for the reaction of the student body as for the poster itself.

5.1.4 Ways for Individuals to Encourage Women

Most of the suggestions in this section involve avoiding behavior that was described elsewhere in the report as potentially offensive. Because the reader is assumed to have read the rest of the report, a minimum of justification appears in this section.

Fighting Subconscious Bias

As described in Section 1.2.1, many people treat men and women differently without realizing it. Once people understand that it is possible for a well-meaning person to unintentionally discriminate, they should train themselves to oversee or spot check their behavior to make sure they do not behave in such a manner. Anecdotal evidence suggests that, once people become aware of subconscious bias, they often catch themselves behaving in such a way. This is true of women as well as of men. Fortunately, once a person is aware of the problem, the behavior is usually easy to change. Examples of behaviors to avoid are:

- Assuming, without any information, that women should be given easier questions or projects than men.
- Paying more attention to remarks made by men than by women.
- Assuming, when introduced to a team, that a male is the leader and primarily addressing comments to him.

- If a man, being more friendly and encouraging to male peers and subordinates than to females, even if it is out of a desire to avoid having one's friendliness mistaken for flirtation.
- Assuming that a woman will not pursue her career as seriously as a man because she will leave her job to have children. While some women take time off for children, all women (and no men) are hurt by this prejudice.

Additionally, one can help counteract another person's subconscious bias by either discreetly calling it to the person's attention or by directly offsetting it. For example, if a female colleague keeps getting interrupted or ignored, one can express interest in what she is saying without directly telling people to listen to her, which might be interpreted as patronizing.

A female graduate student provided me with some positive examples of how her advisor treated her. In addition to generally treating her with respect, by giving her challenging projects and the necessary resources to complete them, there were two specific things he did that especially impressed her:

- When the student was preparing a paper the two of them co-authored for a conference, she made a dozen copies to send in, as required by the program committee. When her advisor saw her collating them, he told her that she should have had the group secretary do that. The student was impressed with this remark because she felt other professors might see nothing wrong with a female's doing clerical work but would have only redirected male students to a secretary.
- When the student proofread a paper for her advisor, he thanked her by name in the acknowledgments "for her careful proofreading of this paper and [acknowledged] her ongoing study of [related research area]". By mentioning her research area, the advisor made clear to readers that, despite her female name, she was not a secretary.

Avoiding Unintentionally Offensive or Discriminatory Behavior

While any well-intentioned person avoids behavior that they know to be offensive, some people do not realize that certain behaviors, discussed throughout this report, offend some women. Good intentions are no guarantee that women will not get the wrong message. For example, a woman might feel uncomfortable with a man who has revealing pictures of women on his walls or computer screen. Additionally, by not using language that could be interpreted as sexist, such as "he" for the generic computer architect and terms like "manpower", women feel more included. One positive example is the name on a sample application for the United States Department of Defense fellowships, included in the instruction booklet: "Smith, Dana Robin." Both "Dana" and "Robin" can be either female or male names. Another positive example is the alternating usage of “he” and “she” as the default singular program in chapters of the influential *Computer Architecture: A Quantitative Approach*, by John Hennessy and David Patterson. There are many guides to “nonsexist” communication, such as [Persing 1978].

Someone who supervises a research or work group or organizes its events should try to choose activities at which all group members would feel comfortable. While it is not always possible to choose an activity that everyone relates to — for example, some people are uninterested in any sport — an effort should be made to include everyone in at least some of the social occasions. I have seen people repeatedly left out of social activities springing from the workplace because they are poor athletes or disabled, have unusual dietary requirements, or do not drink alcohol. Anyone who cannot socialize with the group will not feel as though they fully belong. (Conversely, anybody who does not want to socialize with the work group, for whatever reasons, should not be made to feel unwelcome as a worker.)

Encouragement

Some professors rarely encourage or praise their students, but such encouragement, even if just a few spoken words, is greatly appreciated and rarely forgotten [Widnall 1988, page 1743]. For example, suggesting that a student consider graduate school can make a substantial difference [Leveson 1989, page 23]. In one survey of female scientists, “[t]he encouragement of teachers — along with that of fathers — was the influence most frequently quoted as steering [them] towards science” [Ferry et al 1982, page 27]. In practice, women often do not get encouragement from teachers and guidance counselors ([Cooper Union 1989] in [Baum 1990, page 48]). While encouragement should be directed to worthy males and females, it has greatest effect with people who receive little encouragement and who have low self-esteem, often women [Zappert et al 1984, page 8]. (See, for example, page 10 of this report.)

Additionally, it is important for parents to encourage their daughters as well as their sons in technical areas. “According to one computer camp director, ‘Mothers bring their boys to the classes. Girls have to beg to enroll’” [Hess et al 1985, page 201]. Even if parents do treat their children equally, it is impossible to make girls feel that it’s as normal for girls to use computers as it is for boys, with all the biases in our society (Section 1.1.3) and in children’s toys and computer games (Section 1.1.2). Nevertheless, it is clearly important to encourage one’s daughters, and many female computer scientists attribute their career choice and success to parents who encouraged them.

5.1.5 Discussion

Readers will notice that there are many situations for which I made no recommendations. For example, I had no advice for the woman who told me about dining with a group of men after a conference who then began telling jokes that were specifically degrading of women. I also have found myself with nothing to say when a brilliant female graduate student says she avoids a certain research area because of the specific men at the university involved in it. Unfortunately, there is a substantial class of behavior which is both offensive and non-actionable.

5.2 Conclusions

A common thread through the previous chapters is that, for the most part, people are not consciously trying to discourage women from science and engineering. Instead, people's behavior is often subconsciously influenced by stereotypes that they may not even realize they have. Additionally, when companies direct technical games and products to men, their intent is not to perpetuate stereotypes but to target the largest existing audience. That some women feel uncomfortable in mostly male environments is not primarily a result of men's trying to make them feel unwelcome but of dynamics resulting directly from the male majority and societal sex-based differences in behavior. While perhaps it is comforting to know that no conspiracy exists against female computer scientists, it also means that the problem is harder to fight. The negative influences described in this report are so varied and decentralized that there is no simple way to level the playing field.

One positive factor is that women and other underrepresented groups are becoming a crucial resource pool. The number of white males of college age is decreasing, while the need for engineers and scientists is increasing [Leveson 1989, page 7]. I have been told this is causing even the most conservative businessmen to begin aggressively targeting women and minorities as highly-trained technical workers.

Another reason for optimism is seeing how greatly the situation has changed. Although discrimination against women continues, it is nothing compared to the level earlier this century or in the previous one, as some of the quotations at the beginning of chapters have indicated. Unfortunately, there has been retrograde motion before: In the 1920s, feminist activity reduced sexual discrimination at prestigious universities, but "this trend toward equity was reversed in the 1930s and not resumed until the 1960s" [Simeone 1987, page xi].

Appendix A

About This Paper

A.1 Data Collection Methods

In this document, I include some anecdotal evidence in addition to quoting other studies and reports. One way I solicited information was through computer networks. I posted requests for information to private and public electronic mailing lists — that is, systems that allow a person to send messages from their computer to the computers of other people. My initial request is included in Figure A.1. It was sent to a private list of women in computer science and the following public "newsgroups" (electronic bulletin boards): comp.society, comp.misc, alt.folklore.computers, comp.edu, soc.women, and soc.feminism. From the net, I got roughly 150 responses. Some of these included pointers to published reports or to examples of sexism or anti-sexism in published works. These letters often included reactions (such as "I found such-and-such upsetting") and opinions ("I am opposed to such-and-such"). Other letters included anecdotes. Some of these letters were from sources I had reason to trust (friends of friends); for others, I had no way of verifying any stories. Other categories of letters were polite dissent and "flames" — attacks from people who disagreed with whatever they inferred from my call for information. As described in the introduction, I also learned from my critics and attackers.

The data in my paper falls into the following categories:

1. Published statistics.

2. Quotations from computer books or magazines.

3. Events I have personally witnessed or taken part in.

4. Quotations and paraphrases from published and unpublished reports.

5. Anecdotes and opinions from people I know.

```
For one of my classes ("Women and Computers"), I'm doing a
project on ways in which the message
"Computers/Science/Engineering isn't for girls/women" (or
the opposite) is communicated.  Some examples would include:

- Computer ads featuring scantily-clad women.

- An ad I received for a pink calculator that could
  fit in my "chic little handbag", with large keys
  to keep from breaking one's "gorgeous nails."
  (Their words, not mine.)

- Being treated differently by teachers or coworkers.

I've been collecting some of the more egregious examples for
the past few years, and I'm hoping some of you have your
favorite examples.  I am interested in xeroxes or references
to items in print as well as anecdotes.  Despite the
one-sidedness of my examples, I am interested in both pro-
and anti- female material.  Please email me
(erspert@athena.mit.edu) or physically send material to:

Ellen Spertus
MIT AI Lab, room 630
545 Technology Square
Cambridge, MA 02139

I will send copies of my report to anyone who contributes
and/or is interested.  Thanks in advance for any help.
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Figure A.1: Call for Data

6. Anecdotes and opinions from friends of friends.

7. Anecdotes and opinions from people I don't know.

Readers will have their own opinions on how much credence to give to each category. The only category I have qualms about is anecdotes from people I do not know. Consequently, I have never based an argument entirely on them. Unfortunately, anonymity was important to many people who gave stories, and I decided all contributions, except from published or privately-distributed reports, would be anonymous and contain as little identifying information as possible. In my records, I have the source of every piece of data or story, in context. If any reader, for their own studies or peace of mind, needs to know the trustworthiness coefficient of a given anecdote, they can contact me, and I will provide whatever further information I can without violating anonymity. While false anecdotes could have been passed on by dishonest or misinformed sources, it is highly unlikely that more than one or two, if any, exist. In any case, I have prefaced unvouched-for opinions and anecdotes to indicate the level of indirection, i.e. "a female graduate student wrote such-and-such" instead of "a female graduate student had the following experience".

A.2 The History of the Document

This paper was begun during the spring of my senior year, as a term paper for a course entitled "Women and Computers", taught by Prof. Sherry Turkle. Because the paper was so long and because I had other graduation requirements, I did not finish it until the following January, when I presented the paper during MIT's Independent Activity Period. I also distributed the paper through electronic means, mostly to female computer scientists, some of whom further distributed copies. Because of the interest the paper generated and the support of the department, I decided to turn it into an Artificial Intelligence Laboratory technical report, the simplest way to semi-publish a document.

I had expected negative reactions to my report, on the net and at MIT, but I was pleasantly surprised. Only a few netters sent negative email, and nobody at MIT gave me any trouble. In fact, the head of the EECS department, Prof. Paul Penfield, was supportive of the project, providing xerox money, and read the report. The associate head for CS, Prof. Fernando Corbató, attended my talk. A number of computer science professors, male and female, also read the report and expressed encouragement.

I made many changes between the original and this version of the report. In addition to correcting typos, changes were:

- Correcting misleading statistics.
- Incorporating anecdotes and reactions sent in response to the original report.

- Including material from additional articles and books.
- Reworking the section on affirmative action to correct my prior misconceptions.
- Removing an email conversation with a "flamer" that had been included as an appendix.
- Adding an appendix on advantages women have.
- Adding quotations to the beginning of the chapters.

The differences between the two versions are large enough that I would now prefer people to treat the original as a draft and not duplicate or quote it.

A.3 MIT

"Barriers to Equality in Academia: Women in Computer Science at MIT" [MIT 1983], published in 1983 and describing some of the problems faced by women at MIT was distributed widely. Unfortunately, some people incorrectly inferred that MIT was a worse place for female computer scientists than other schools. There is no reason, however, to think that it was any worse than other CS departments. In fact, it was probably better, since there were enough women at MIT to write such a report and the administration was supportive enough to encourage it. I want to take this opportunity to defend MIT's reputation.

Specifically, MIT's CS department is more supportive of women than other schools' in the following ways:

- There is support for reports such as "Barriers to Equality" and this one.
- The sensitivity of the department has been increased by these reports. This may be the reason I do not see pictures here of nude women on walls or computer screens, still common in other places.
- There is an unusually strict policy against romance between faculty and students. Professors are not even permitted to date students in other departments.
- There are no sexist or harassing professors that female graduate students warn each other about.
- There are four female professors, three of them tenured, all of whom have expressed support of female students in one way or another. As of 1989, only 9 departments nationwide (5.6%) have this many women [Gries et al 1991].

- MIT has an outstanding ombudsperson, Prof. Mary Rowe, who deals with bias complaints effectively and tactfully. She is a pioneer in the study of subconscious bias [Rowe 1990, Rowe 1981, Rowe 1985].

Each of these points does not hold for many other computer science departments.

A.4 How to Obtain Additional Copies

Readers are free to make photocopies of this report or sections of it, as long as they are not distributed for direct commercial advantage, and as long as I receive credit as being the author. For information on obtaining additional copies, contact the publications office of the MIT Artificial Intelligence Lab at publications@ai.mit.edu, 617-253-6773, or at the following address:

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If you are connected to the Internet and have access to a Postscript printer, you can obtain additional copies of this report through anonymous ftp by following these steps:

1. Change to a directory, such as /usr/tmp, with plenty of free space.
2. Type: **ftp ftp.ai.mit.edu**, or, if that fails, **ftp 128.52.32.6**
3. At login prompt, type: **anonymous**
4. For password, enter your user name (or any string)
5. Type: **cd pub/ellens**
6. Type: **mget womcs*.ps**, replying **y** to the prompts.

If you have access to a Postscript printer but not ftp, send electronic mail to ellens@ai.mit.edu, and I will email you the report.

Appendix B

Sex-Based Intellectual Differences

> *I deny that anyone knows, or can know, the nature of the two sexes, as long as they have only been seen in their present relation to one another.... What is now called the nature of women is an eminently artificial thing — the result of forced repression in some directions, unnatural stimulation in others.* — John Stuart Mill[1]

> *Dr. Edward H. Clarke's book Sex in Education, or a Fair Chance for the Girls [1873] was the great uterine manifesto of the nineteenth century. It appeared at the height of the pressure for co-education at Harvard, where Clarke was a professor, and went through seventeen editions in the space of a few years. Clarke reviewed the medical theories of female nature — the innate frailty of women, the brain-uterus competition — and concluded, with startling but unassailable logic, that higher education would cause women's uteruses to atrophy!*[2]

Research on Biological Differences

A large amount of research has been done on biological sex-based differences in various kinds of intelligence. Sociobiology is a tricky field, because it is difficult to separate the effects of environment and genetics on individuals. As this report has shown, environmental differences can be immense. Many studies in this field have been flawed by the lack of adequate controls. For example, some studies

[1]Mill, John Stuart. *The Subjection of Women*, MIT Press, 1972, page 22.

[2]Ehrenreich, Barbara and Deirdre English. *For Her Own Good: 150 Years of the Experts' Advice to Women.* New York: Anchor Press/Doubleday, 1978, page 115.

of differential mathematical ability have failed to take into account that the male subjects had taken more math courses than the females [Petersen 1980, page 33] or used different types of toys as children. Researchers have generally found that men tend to have superior spatial ability, while women have superior verbal ability, with both differences developing at puberty [Petersen 1980, pages 31–33]; however, the interplay between biological and social influences is not yet understood [Petersen 1980, Kramer et al 1990]. As discussed earlier in the report, boys are given more toys that would encourage development of spatial skills, while girls are spoken to more by adults. The argument for biological differences, however, was recently bolstered when Doreen Kimura found "that hormonal levels can affect people's performance on certain verbal and spatial tests" [Holloway 1990, page 40].

Reactions

People's reactions to these facts vary. Some people conclude that it justifies women's lack of participation in traditionally-male fields. However, powerful arguments exist against taking such a stand:

> [B]iological factors cannot be the complete answer. In other countries, particularly in Eastern Europe, large numbers of women study science successfully, despite any biological handicap. Nor are biological predispositions necessarily relevant when formulating education policy. Girls usually score better than boys on verbal tests, and boys have more difficulty than girls in learning to read. But schools do not take this as a reason for letting boys drop out of reading classes. Quite the reverse: most schools have remedial reading classes which are used predominantly by boys. Teachers put extra effort into teaching boys to read to make up for any deficiency, whether its origin is biological or social. The same could be done to boost the spatial ability of girls if the problems were considered equally serious [Kelly 1982, page 497].

Additionally, the field of feminist technology argues that technology can legitimately be taught in a manner that plays more to women's strengths, be they biological or environmental, not relying so heavily on fields like mathematics in which men currently outperform women. For example, Sherry Turkle and Seymour Papert found:

> When we looked closely at programmers in action we saw formal and abstract approaches; but we also saw highly successful programmers in relationships with their material that are more reminiscent of a painter than a logician. They use concrete and personal approaches to knowledge that are far from the cultural stereotypes of formal mathematics [Turkle et al 1990, page 128].

Student programmers with the less mathematical style, sometimes men but usually women, are discouraged when in classes that force a more mathematical approach [Turkle et al 1990, pages 131-132]. Turkle and Papert advocate "epistemological pluralism", in which different approaches are allowed to flourish. Similarly, Sally L. Hacker argues convincingly that more mathematics than necessary is required by engineering programs, weeding out students who would be able to succeed as engineers if they did not have to pass timed calculus exams [Hacker 1983]. As one female computer science professor writes:

> [T]here's a committee at the [X] engineering school trying to redesign the school-wide common core curriculum, for freshman and sophomore years. I asked our department's representative to the committee to bring up that the current common core tends to discourage females and minorities because it's too heavily math and engineering oriented (and most of these courses are not needed for CS), and does not provide options to take courses in more people-oriented fields (that are relevant to CS) such as psychology. Apparently the committee chairman said to our representative something to the effect that it is not the mission of this committee to address women and minorities, and thus he would not put this issue on the agenda.

Conclusion

It seems possible that there are biological differences in the way men and women think; certainly, there are currently differences in men's and women's thinking styles. There is no way to tell now how great the biological differences are. While they may imply that women will never reach parity with men in computer science and in engineering, there are two major reasons to believe that women's roles can increase greatly from today's: First, as shown throughout this report, females face immense cultural barriers. Second, as alluded to in this appendix, many technical fields play to men's strong areas. Computer science is built, in large part, on mathematics, which relies on spatial ability. Computer programming, however, does not in itself require spatial ability, and some areas of computer science, such as user interface design, require more knowledge of human psychology than mathematics. Additionally, sex-based differences are a tendency, and their degree of effect in an individual cannot be known.

Appendix C

Advantages for Women

When writing in the body of the report of all the disadvantages women face, occasionally an advantage for women would come to mind. In the name of fairness and in order to end the report on a positive note, I am including them here:

- The flip side of a woman's being less likely to have a spouse devoted full-time to supporting her career (page 32) is that she is more likely to have a spouse who earns money. A female engineer told me how her husband's income allowed her to quit a job she hated and spend three months looking for one that she loved.

- Although males outperform females in mathematical ability, females outperform males in verbal ability (page 83). In the academic world of "publish or perish," being able to write clearly and properly is a large plus.

- If people are more likely to help members of the same sex (page 30), and if women are currently raised to be more sensitive than men (page 20), women will get tremendous support from their same-sex peers. (I have found my female colleagues extremely supportive.)

- It is not entirely disadvantageous that girls tend to be taught how to cook and keep house instead of how to fix bicycles (page 9). Being able to cook for oneself at college is healthier and cheaper than having to rely on cafeterias or junk food.

- While all women are to some extent penalized out of the suspicion that they will take time off their career to have children (page 33), they have more freedom to do so than men. A woman's career can be salvaged if she takes time off to spend with her young children, but a man would be considered insanely irresponsible.

- Ingenuity can transform other disadvantages into advantages, as explained in Betty Lehan Harragan's wonderful *Games Mother Never Taught You*. For example, she points out that, while women hate being constantly in the spotlight, men "fantasize about how well *they* could exploit such a favorable situation.... Today's pioneer women can begin taking command of situations by merely accepting their unique position in the spotlight" [Harragan 1987, page 311].

Most important, with a positive attitude, women can make the most of their situation. The successful female computer scientists I know do not say, "I could have gone further if I were a man." They say, "I had to work a lot harder than a man to get where I am." Although the two statements may be equivalent, self-assuredness is psychologically more useful than self-pity. Additionally, even women who have been discouraged sometimes succeed out of spite.

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