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Confronting the "Socialization" Barrier: Cross-Ethnic Differences in Undergraduate Women's Preference for IT Education

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I would say that they're unique, you see them as ... you look at [a] girl ... she'd walk in as a fresher taking classes, and me and my friends always say that we'll give her three weeks. I mean maybe I'm being inconsiderate, maybe I'm basing it on appearance, and how she looks at a computer and the way she reacts to the computer versus somebody who comes and sits on the computer and knows, and is very, like,... knows all the windows tricks and knows all the commands.... So based on the lack of feel for the computer [I or other males view females in the way described].

—a male student

And ... men seem to have, at least some of the men that I've met in there,... seem to have more of a different attitude. Like, you know, I'm worried about whether I know everything. And there're a lot of guys that I've met in the program who may not know as much as me, but they've got the attitude that they know a lot ... so I'm wondering ... if they are going to have no problem getting a job after graduation, just because they have that attitude on, yeah, I know this, or I am so experienced. You know, that sort of a thing. Whereas the women tend to not act like that.... It's like sometimes I feel I have more knowledge, but they're more open about or they're more confident about what they think they know.

—a female student

The fact that there are fewer female students in computer science and computer engineering (CS/CE) courses, as compared to males, has been a serious concern for academics and policymakers (American Association of University Women 2000; Carver 2000; Camp 2002; Varma 2003). Scholars have not only analyzed different facets of gender disparity in CS/CE but have also attempted to provide policy guidelines in order to change the existing situation. A number of factors have been identified as affecting the enrollment and retention of female students in CS/CE programs such as: computer games being seldom designed with girls' interests in mind (Cassell and Jenkins 1998); the masculinity of computers, a lack of confidence, and gender socialization (Margolis and Fisher 2002); motivational differences (McClelland 2001); differences in learning strategies (Stepulevage and Plumeridge 1998); behaviors

and negative attitudes toward women (Seymour and Hewitt 1997; Crombie, Abarbanel, and Anderson 2000); and the crises of nontraditional students, a lack of debugging skills, and poor time-management skills (Varma 2002).

This chapter, which is based on in-depth interviews with 150 male and female students belonging to five different ethnic/racial groups, is an attempt to contribute to this debate. We analyze the perceptions of male and female CS/CE undergraduate students with regard to gender-related issues and show how they are articulated. We shed light on the processual nature of the articulation of gendered perceptions by:

- showing how they occur through a dynamic and dialectical interplay of several factors such as gendered socialization, the attitudes of male students and instructors, the perception of females of their position in the program, curriculum, and so on;
- highlighting how the social backgrounds of racial/ethnic groups as well as males and females critically impact their perceptions.

We utilize Pierre Bourdieu's concept of "habitus" to explain how a set of experiences—in the school and through socialization at home or outside—constitute the "dispositions" of male and females students, which continually reproduce gendered and gendering differences, even though, as we found in our study, a majority of both male and female students feel that there is no gender difference. The two quotes at the beginning of this chapter—definitely not exceptions—exemplify that social environment in CS/CE programs is evidently gendered. The relevant thing to note about these quotes is that because gender differentiation constitutes the habitus of the students, even simple everyday actions are articulated through a gendered lens, which contributes to the further gendering of social interactions within the CS/CE field.

Before we move further, we would like to clarify how we are using the concept of habitus. According to Bourdieu, "the structures constitutive of a particular type of environment (e.g., the material condition of existence characteristic of class condition) produce *habitus*, systems of durable, transposable *dispositions*, structured structures predisposed to function as structuring structures" (1977, 72). Three aspects of Bourdieu's theory of practice, which are embodied in his concept of habitus, are relevant for the argument presented here:

- Any social action is articulated through the dialectic of past and present experiences. Past experiences, such as early childhood socialization, play a role by constituting the dispositions of the actors, but they acquire significance only in relation to the present social context within which the actor is performing his or her action.

- Social interaction between two individual actors always bears the imprint of the broader social context, which is embodied in one's habitus. The habitus is stable, but continually transforming through the dialectic of past and present experiences and individual actions in relation to the broader social context.
- Social actions are not simply a result of the objective evaluation of the conditions (e.g., instructor's gender bias) but always concatenated with one's subjective evaluations of the event, which is done through the dispositions that constitute one's habitus.

Through the concept of habitus, we argue that there are several social practices or experiences that explain and cause gender disparity in CS/CE programs. When students interpret particular social actions (such as the presence of fewer females or the instructor's behavior), all these practices are concatenated because they are expressed through the habitus and not simply as a response to the particular and immediate event. Males and females, however, interpret particular social interactions and the existing conditions within the CS/CE programs differently. We found that there are differences also along racial and ethnic lines. We contend that this happens because the set of dispositions that constitute the habitus of males and females, and also different racial/ethnic groups, are somewhat different, which makes them give different meanings to the same actions, or give a gendered connotation to a common and everyday social behavior.

Method

The focus of the study was undergraduate women in different ethnic groups. Interviews were conducted with women who had decided to major in the computer science or computer engineering fields so that they could identify the reasons for their attachment to a CS/CE education and career despite various barriers. In addition, the views of male students in each ethnic group for a comparative analysis were sought. The study was carried out at four-year colleges and universities that granted undergraduate degrees in one or more CS/CE programs, and were designated as a minority-serving institution such as a Hispanic-serving institution, a historically black college, or a tribal university.

Primary data were acquired through in-depth interviews in 2002–2003. The sessions involved using interview guides, asking open-ended questions, recording the answers, and following up with additional relevant questions or probes. The

technique of in-depth interviews was considered useful mostly because there is little information on the barriers women in different ethnic groups face in pursuing CS/CE.[1] Interviews also seemed the most appropriate way to track down the factors relevant to a preference for CS/CE education. Interactive probing through interviews permitted access to the unconscious and inaccessible aspects that had a bearing on the tangible and intangible barriers women face in pursuing a CS/CE education.

Interviews were conducted with 150 subjects, including 15 male and 15 female students at seven institutions majoring in computer science or computer engineering, and belonging to each of the following five racial/ethnic groups—namely, white, black, Hispanic, Asian, and American Indian.[2] Random sampling was used to select subjects on sites with sufficient numbers of women and men. Nevertheless, purposive sampling was used on sites where the numbers of some minority groups (e.g., American Indians and Asians) and women majoring in either discipline were small.

In this chapter, we have analyzed the responses of our interviewees on eight out of a total of sixty-one questions that we had asked them: In your opinion, what is it like to be a woman in your CS/CE program? Do any incidents come to mind that are related to being a woman in the program? Do you consider yourself as strong or stronger in CS/CE as the other women and men in your program? Why do you think there are so few women in your CS/CE program? Do women encounter obstacles that men do not? In your experience, how do the men you know in CS/CE view the women in their program? In your opinion, are careers with a CS/CE degree attractive to women? And if you could change some things about your current CS/CE program to make it more attractive to women, what would they be and why? These eight questions were chosen because they reveal the perceptions of female and male students with regard to gender-related issues.

Being a Woman in the CS/CE Programs

> Just that sometimes, like, I'm scared to speak or ask questions because, you know, I mean, guys might think, you know, because I'm a woman. You know, 'cause I'm a lady.
> —a female American Indian student

When the students were asked whether any incident comes to mind that is related to being a woman in the CS/CE program, 58 percent of them said none (see table 10.1). More females replied in the negative (62.7 percent) than males (53.4 percent). Yet what we found is that even when students negated any experience of gendered

Table 10.1
Memory of incidents related to being a woman in the program

	White (%)		Black (%)		Hispanic (%)		American Indian (%)		Asian (%)		
Categories	F	M	F	M	F	M	F	M	F	M	Total* (%)
None	47	53	60	60	73	40	73	60	60	53	58 (87)
Prejudice	13		20	7	7	13		7	13	7	9 (13)
Instructor-related issues	13	13		20		7		7			6 (9)
Socialization	7					7	7	7	13	7	5 (7)
Privileged		13	7			13	7	7			4 (6)
Fewer females	7	13									2 (3)
Other	13	7	7	7	20		7	13	7	20	10 (15)
No response			7	7		20	7		7	13	6 (9)
Total	100%	99%	101%	101%	100%	100%	101%	101%	100%	100%	101% (150)

Note: *Totals in the right-hand column are in percentages (rounded off to the nearest whole number) with the actual numbers in parentheses.

interactions in the program, they would often still express that there were some essential gender differences between males and females. For example, one female student said, "No.... Mainly, they [males] adapt more easily so." Another female student added after replying in the negative, "I guess we're more stubborn."

The consciousness of being a female (and different from males) in CS/CE is reinforced for a variety of reasons, most of all due to the fact that there are fewer females in these programs. When the students were asked, "What is it like to be a woman in your CS/CE program?" a large number of them (27 percent) mentioned the presence of fewer females (see table 10.2). When students were asked about incidents that related to being a woman in the program, the response of only 2 percent was that there are fewer females.

Bourdieu (1977, 1990, 2001; see also Moi 1991; Krais 1993; Swartz 1997) argues that "symbolic violence" is an important strategy of the dominant group to control and maintain its privileges and practices. Symbolic violence, according to Bourdieu, does not entail any overt acts of violence; rather, it is a method of censoring voices, beliefs, and practices by designating them unorthodox (or "heterodox," as Bourdieu would put it) or anomalous in relation to the already existing practices and beliefs (which are favorable to the members of the dominant group). The first instance of symbolic violence, however, as our study shows, occurs not in censoring certain behaviors and practices but in defining the presence of a group in a particular domain such as a specific career or program in college (in our case, females in CS/CE programs) as an anomaly. Hence, the very fact that there are fewer females in CS/CE programs becomes an anomaly that needs to be explained and made sense of. To clarify at the outset, we are not trying to assert that there are no gender or racial/ethnic differences, or that such differences are constructed with no real basis. Instead, what we are attempting to show is how the presence of fewer females necessitates that both males and females make sense of it through essential gender differences—and this is done in relation to an individual's past experiences.

Both the males and the females in our study utilized their habitus (i.e., their past social experiences embodied in their consciousness) to make sense of the anomaly of fewer females in CS/CE through the gendered categorization of behaviors and abilities. Males (29 percent) were more conscious of the anomaly of the presence of fewer females in CS/CE than females were (24 percent). One of the male students said, "I think, the only thing I can think of is in some of the classes I've been, there might be like two girls, maybe two or three girls. And they sort of sit together, and *it's almost them against us*, or something like that" (emphasis added). The presence of fewer females, therefore, constitutes the first instance of the gendering of the CS/

Table 10.2
What is it like to be a woman in your CS/CE program?

	White (%)		Black (%)		Hispanic (%)		American Indian (%)		Asian (%)		
Categories*	F	M	F	M	F	M	F	M	F	M	Total* (%)
Fewer females	33	47	7	13	33	40	20	7	27	40	27 (40)
No gender difference	33	13	27	27	27		20	33	40	7	23 (34)
Prejudices	7	13	20	7	13	13		7	7	13	10 (15)
Privileged		7		7		33	7	7		20	8 (12)
Equalizer	7		13	13	7		7		13	7	7 (10)
Racial minority			13	7	13		7	13			5 (8)
Male preoccupation			7	7			7	7			3 (4)
Discrimination	13	13									3 (4)
Other	7	7	13	20	7	7	20	20	7	13	12 (18)
No response						7	13	7	7		3 (5)
Total	100%	100%	100%	101%	100%	100%	101%	101%	101%		101% (150)

Note: *Totals in the right-hand column are in percentages (rounded off to the nearest whole number) with the actual numbers in parentheses.

CE programs.[3] Moreover, since the present context (the presence of fewer females) is framed in relation to the already existing habitus in the student's mind, the relationship becomes gendered and females are marked out. Hence, even though a majority of students say that they cannot think of instances that remind them of being a woman in the CS/CE programs, we have to be careful because very often simple, everyday actions that may not seem gendered, exemplify gender differentiations.

Among the males, more whites (47 percent), Hispanics (40 percent), and Asians (40 percent) noticed that there were fewer females than blacks (13 percent) and American Indians (7 percent). Interestingly, whites (13 percent), Asians (7 percent), and Hispanics (0 percent) were also the least likely to respond that there was no gender difference. Males belonging to these three ethnic/racial groups were also much more unsympathetic in their responses toward the existing gender disparity in CS/CE programs. An Asian male said, "To be a woman in computer science? It is greater [better] if you just change your major into something else. [Why do you say that?] Because, like, just stories I've heard and its inside scene from different professors. I don't think that they expect a woman to be in the computer science field. Nope."

Similarly, a white male responded, "I think that there is a lot of bias that comes in and it's also a part of the mentality of the woman coming in. She thinks that there's going to be a bias so she can find it where she needs to. I think that in general, this department has been very, very good about accepting female students and female faculty, and being very warm and accepting of, or rather impartial toward, either men or women. However, there're of course those issues everywhere, so." Black (27 percent) and American Indian (33 percent) males more often responded that there was no gender difference, and they were also more sympathetic when they talked about prejudice toward females. This could be because blacks (10 percent) and American Indians (10 percent), apart from Hispanic females (13 percent), were the only ones to express that their racial status further erodes their numbers in the class. A greater consciousness of racial discrimination perhaps makes the students belonging to these racial/ethnic groups more sensitive to gender discrimination.

As for the females, the consciousness of their anomalous position sometimes makes them respond negatively to what is regarded as feminine. A black female student reflected such a concern vividly when she said, "Like, there's this one girl that's in the program. And ... I guess, to a guy, she wouldn't appear to look smart, I mean because, like, she, you know, tries to dress up every day. You know, be all pretty or whatever, like wear heels, ... she wears dresses really feminine.... And I guess *guys kind of tend to see her as, like, a girl rather than a, like, a smart person*" (emphasis added).

Very often females, like their male counterparts, made sense of the presence of fewer females in the CS/CE programs through gender differences. For example, a white female student said, "I don't think it is any different from being a man. It just so happens that men have more logical minds. You know what I mean? Women are good at English, [and] men are more good at math. That's, like, always been the kind of norm. But for some odd reason, I'm better at math. But there is generally a lot fewer women in computer science than there are men."

The response of the female student exemplifies the processual and dialectical character of gendered perception, and illustrates the importance of our framework in analyzing gender-related issues in CS/CE programs. The student begins with a negation of gender differences; thereafter, she expresses the stereotype of an intrinsic male-female difference and then attempts to explain her own ability (of being good at math) by pointing out that she may be an exception because there are so few women in the program. Moreover, as the quote at the beginning of this section shows, a particular reaction of being a female is intimately connected to a female's perception of how a male thinks about females. Such a perception, however, is not a figment of females' imagination; it has to be seen in the broader gendered context of the CS/CE program.

Being a woman in the CS/CE programs at present, therefore, means to be constantly aware that they are perceived as an anomaly. Males are more conscious of this, and their day-to-day actions, which are interpreted through a gendered lens, continuously reinforce a gendered interpretation of women's actions and even their presence in the program. There are racial/ethnic differences among the responses of the males, as we have described, but it seems the consciousness of being a woman far overwhelms the responses of females and hence shows insignificant ethnic/racial differences. Nevertheless, females—not unlike the males—very often interpret the presence of fewer females through essential gender differences.

I Am As Good If Not Better

> Actually, I think I'm definitely as good as them.... I don't want to say I'm better, but I work harder.
> —a white female student

Students were in general guarded in their response to the question of whether they consider themselves as good as or better than other female and males students in the

CS/CE program. Nevertheless, the responses of the students show some fascinating gender and racial/ethnic differences (see table 10.3).

A significant percentage of male students (27 percent) chose not to respond to this question. In terms of race and ethnicity, a majority of the white (67 percent) and black (53 percent) males did not respond. We cannot ascertain the exact reasons for these nonresponses, yet it is evident from the people who did respond, particularly the females, that they responded because they felt the need to expressly prove their worth. Thus, the racial and ethnic differences in the no response category could be a reflection of who feels the need to overtly state their worth. Students were aware that even though the presence and success of males is considered a norm in the CS/CE field, it is the white male who forms the role model in this regard. A black student, while responding to what it was like being a woman in a CS/CE program, said, "As far as being a woman, I don't think they expect too many women to be in that area; as far as black woman, they don't expect you to be there at all. They all expect [it to be a] male issue, a white male issue." What we are trying to indicate is that students are aware that CS/CE programs are not only seen as male domains but usually the white male is seen as the role model, and that impacts students' responses, particularly those of blacks and whites, perhaps because race in the United States is so often seen through the dualist lens of white and black.

Irrespective of their race or ethnicity, a majority of females said that they were as good as, if not better than, other students, including the males. If we add to this category of females, other females who thought they were better in some areas and not in others (i.e., who responded yes and no), we find that almost 80 percent of women felt confident that they were as good in CS/CE as anybody else in the class, at least in some areas. In terms of racial/ethnic differences among the females, the Asian students' responses stand out. All the Asian females felt that they were as good as, if not better than, their classmates. A significant percentage of Asian women (67 percent) also felt that females do not encounter any obstacle that is unique to being a woman in the program. As one Asian female remarked, "Like, the whole gender thing doesn't really intimidate me at all. I'm just another person in the same program as they are."

Female and male students cited several reasons why they felt they were as good as, if not better than, their female and male classmates (see table 10.4). A large percentage of students (42 percent) felt that they were as good as anybody else (i.e., their response was "same"). One student responded, "I'll say about the same. There are some qualities that some people have that other people don't, so like it kind of

Table 10.3
Are you as strong or stronger than other female and male students?

	White (%)		Black (%)		Hispanic (%)		American Indian (%)		Asian (%)		
Categories	F	M	F	M	F	M	F	M	F	M	Total*
Yes	73	27	87	20	60	53	80	60	100	53	61 (92)
Yes and no	13			13	13			7		13	6 (9)
Don't know				7						7	1 (2)
No	13	7	13	7	20	7	13	7			9 (13)
No response		67		53	7	40	7	27		27	23 (34)
Total	99%	101%	100%	100%	100%	100%	100%	101%	100%	100%	100% (150)

Note: *Totals in the right-hand column are in percentages (rounded off to the nearest whole number) with the actual numbers in parentheses.

Table 10.4
Reasons why a student thinks s/he is as strong or stronger as compared to other students

	White (%)		Black (%)		Hispanic (%)		American Indian (%)		Asian (%)		
Categories	F	M	F	M	F	M	F	M	F	M	Total* (%)
Same	15	25	38		36	75	58	70	33	50	42 (42)
Drive	8	25	15	20	9		8				7 (7)
Attitude	8			40					13		6 (6)
Hard work	8					13	8			10	4 (4)
Grades	8								20		4 (4)
Grasping ability	8								13		3 (3)
Experience	15									10	3 (3)
Knowledge		25						10			1 (1)
Variable	8		15	20	18	13		10		20	10 (10)
Other	8			20	9		16	10	20	10	10 (10)
No reason given	15	25	31		27		8				11 (11)
Total	99% (13)	100% (4)	99% (13)	100% (5)	99% (11)	101% (8)	98% (12)	100% (10)	99% (15)	100% (10)	101% (101)

Note: *Totals are in percentages (rounded off to nearest whole number) with the actual numbers in parentheses.

all averages out in the end." Some students felt that they were as good as others because of their attitude or drive. One Asian female student, who thought she was as good as, if not better than, others because of her attitude, commented, "I may be better than many students because of [my] strong background in math and sciences back in India. I think you have to be smart to be successful." But then she added, "A lot of smartness does come from learning, so at the beginning nobody knows anything." Among the students who thought they were not as good as others (i.e., responded no), drive (39 percent) was cited as an important reason.

It has been generally argued that females in CS/CE programs suffer because of a lack of confidence. Males also feel the need to bolster their confidence every once in a while, however. An Asian male said, "Yes, [I am as good as others,] as I get to know more people, I feel more confident because some of the people that I consider to be really smart, I actually find that I am on the same level as some, not all of them, but more than I thought." The crucial thing to note here is that even though this male student expresses some insecurity with regard to his confidence, it is not given a gendered spin. This again exemplifies our claim that the marking out of the females, which occurs in the context of the presence of fewer females, leads to a gendering of only female behaviors and practices.

Often, males as well as females referred to their grades, ability to work hard, or job experience to argue why they were as good as, if not better than, other students. Several male students belonging to different racial and ethnic groups said that they found many of their female friends as smart as, if not smarter than, themselves. A belief in one's ability, as is evident from the answers to the question "Do you feel you are as good as, if not better than, others?" does exist among the females, and often males also thought that their female colleagues were as good as them. But such a belief is frequently challenged by the belief in and experience of males' chauvinistic behavior toward females in CS/CE programs. We have to keep in mind that males need not directly express chauvinistic behavior toward females in the classroom or otherwise. But because social interaction in the CS/CE programs take place through and within a set of dispositions (that constitute the habitus of these students) that is gendered, such evaluations are not unusual, and even one action that reflects such chauvinism enforces such a belief. That is to say, male-female interactions in CS/CE programs, even if they are between particular people and about particular issues, often have a broader connotation and have to be analyzed as such.

When the students were asked how the males in CS/CE view their female classmates, most of the students (56 percent of the females and 60 percent of the males)

replied that males treat females as equal and as peers. Yet 20 percent of the females and 13 percent of the males thought that men were chauvinistic—in the sense that there is a belief that men think that they are smarter or more capable than women. A white female said, "I'm sure they think that we aren't anywhere as good as they are. They're all extremely egotistical." When she was asked how the women viewed the men, she replied, "They're all nerds. They have absolutely no lives. Yeah ... and nothing else." A Hispanic female observed that "they think that you are not as smart as they, but you know it's normal." Such beliefs and experiences, even though they are not that of the majority, continue to affect the interactions in CS/CE programs because they start constituting the dispositions of students, leading to, for example, a lack of confidence or fear among females about presenting their ideas. Habitus as a theory of practice, therefore, provides a useful framework to understand how social interactions in the CS/CE programs have a gendered impact because they are articulated through the dialectic of past and present experiences, and concatenated with other social actions that constitute the broader context that is gendered.

Males, when they talked about male chauvinism, said that they thought or had heard other men refer to females in the class as "little sisters." It is relevant to note that the same students who talked about females being referred to as little sisters because the females, according to them, needed help, did not use a similar phrase for the males needing help. Again, with regard to male chauvinism too, particular social experiences have an impact on how people think. As a black male told us, "A few have issues with them [females]. Like, they feel that a woman is inferior, period. And since I grew up in an intercity black family with a woman as the head of my household, so I view women totally differently." What we find is that because of the differing habitus of different racial/ethnic groups, and among males and females, the reactions are different.

There were several students who cited instances of gender prejudice in the CS/CE programs (see table 10.1). Among the responses of students, three categories stand out: prejudice (9 percent), instructor-related issues (6 percent), and socialization (5 percent). Another category, privileged (4 percent), also bears on students' responses. The relevant thing to note about these responses, however, is that even though they can be classified in different categories, it is evident that most often they reflect a person's wider set of dispositions that constitute his or her habitus. Hence, a black male student replied, "There is a fellow classmate of mine, whenever she produces work, it's questioned because, you know, they might say, 'Oh, where did you get it from? I

know you didn't do it. Who did you copy it from?'" When we asked the student why that is the case, he responded, "Because, no offense, but most of them do that, they use the fact that they are female to get things done. I've seen personally even teachers are submissive to females rather than males, and, like, once that happens to a few girls, it's kind of, like, everyone's questioning all females and, like, that's [a] problem."

As we can see from this quote, even though the student expresses a genuine concern over the way his female friend is questioned, his explanation eventually takes a gendered form. Male students, even when they mentioned cases of prejudice against females, explained the existence of such prejudice as a result of the females' dependency, which arises out of their being privileged. Female students are well aware of the existence of such a conception among males and its implication toward discrediting their work. A female student informed us that "some classmates, like one or two, they say, like, if I get an interview or whatever, they say it's because, like, I'm pretty.... And that's not true, [I get interview calls] because I've [got] a good GPA and I have a nice résumé."

Several male students, irrespective of their race or ethnicity, expressed that females receive privileged treatment. They are often aware that their female colleagues perceive the treatment meted out to them differently. Nonetheless, they continue to believe that females are more privileged. A white male student put it thus: "The only thing that comes to my mind is, there is a special treatment, for instance by Professor S.... From what I remember, the few girls in this class, essentially what happens is, he makes it easier for them to pass, at the same time what I heard from them, he makes it more difficult for the girls to pass." It seems confounding how males and females belonging to the same class view the behavior of the instructor so differently. The problem is that because of socialization at home as well as in school, and the fact that CS/CE programs reflect gendered constructions in different ways, the males' dispositions are tuned to see females as an anomaly within the CS/CE programs, and so they continue to visualize different actions and behavior along gendered lines, which in turn leads to the further gendering of social interactions.

A larger percentage of female students (15 percent) stated that there was no gender difference as compared to male students (8 percent), and almost an equal number of females from different racial/ethnic groups thought there was no gender difference. Irrespective of their racial or ethnic status, though, an almost similar number of females and males felt that there were prejudices against women in CS/CE programs. Sometimes, such prejudices were interpreted through the lens of

intrinsic male/female difference, but women in general expressed confidence that they are competent enough to cope with it. Several women, irrespective of their racial or ethnic status, also thought that the fact that females are beginning to join CS/CE programs, and hence going against the stereotype, is acting as an equalizer. Again, this was at times expressed in light of the particular social background of a student. For example, a black female student said, "As far as, like, being a minority woman, not everybody is a minority it seems like. But being a minority woman, it is kind of neat just because you know, like, it's saying you know, like, you are being masochistic, you know what I mean. I don't know, it is just kind of neat."

CS/CE Careers for Women

> Some [CS careers] are [good for women] and some aren't. A lot of women don't want to be away from home or away from the family. I'm a really family-oriented person, and a lot of my friends are.... I don't think there are a lot of positions where you could say, "I'm a woman. I want to do this." ... You know, you might have kids. You know, it's still all that maternity leave thing. You know, even with all the laws and everything. But still, I think it's a hindrance for a lot of women.
>
> —a black female student

A majority of students (62 percent) said that a CS/CE career was favorable to women. A larger percentage of females (68 percent) thought this to be the case than males did (56 percent). Students cited a variety of reasons to explain why a CS/CE career was favorable to females.

The responses of the women who said that a CS/CE career is attractive reflect a combination of the advantage of being fewer in number, and hence in greater demand, and the advantages they have over males. A black female said, "Yes. Because I believe that companies are going to look for a token." An Asian woman explained, "Personally, I feel like that gives us an advantage to be a woman just because they don't have so many, and they'd wanna kind of change things, as an advantage. I just applied for an internship and there were some group activities, and at the group activities the guys were, like, more pouncing on each other, trying to take step, and the girls were kinda more relaxed, and we got the problem solved."

Some women thought that a CS/CE career is attractive to females because they can work from home (5 percent). The fact that a CS/CE career nowadays allows for the possibility of working from home was a big relief for several women because, as the quote at the beginning of this section shows, being at home and with their

family is a big concern for females. In our sample, at least some males and females belonging to all five racial/ethnic categories had children (while none of the males had more than two children, some of the females did). Yet it was only the females who mentioned that taking care of children and home took up a lot of their time. Females also stated they would like to combine having a home with children and their work; no male expressed such a desire, even though several of them had children too. Several females thought that a CS/CE career was attractive for females because it was challenging and satisfying. A white female said, "To me it is. Because that's what I want to do. And it's satisfaction. It's hard, but it's fun. It's challenging. I get a sense of accomplishment. But, yeah,... you could get that somewhere else, but for me, it's been the only field where I've actually been challenged." One encouraging aspect of the females' responses was that some of them cited their own case as evidence that women should find a CS/CE career more attractive.

Among the people who said that a CS/CE career was not attractive for women, the most frequent reason cited was that it is unfeminine (33 percent). Males far outnumbered the females in saying that a CS/CE career may not be attractive for females because it is unfeminine. Forty-one percent of the males who thought that a CS/CE career was not attractive to females, said it was because the career was unfeminine. More white (27 percent), Hispanic (19 percent), and Asian males (13 percent) gave this reason than blacks (6 percent) and American Indians (7 percent). These cases again illustrate how the responses of males and females as well as those of different ethnic/racial groups are guided by their habitus.

We were also interested in finding out what suggestions students themselves had for making CS/CE programs attractive to women. We found that a large percentage of the respondents (25 percent) were unsure of what changes could be made for this purpose. Some of them (8 percent) said that no change was required in the system.

Nearly 10 percent of the respondents felt that hiring more women faculty in CS/CE programs would make them more attractive to females. A white female noted, "I think more female faculty would help. Especially undergrad. To have somebody to go to and talk [to]. Because female, women, talk differently than men." The males who suggested that having more female faculty would make CS/CE programs more attractive to females, thought that it would provide females with more role models. "I suppose it would help to have more role models for women," one white male commented. A black male responded, "Maybe have more minority women faculty. We can't change the way people think, and especially older people, you know they're like, this is the way I've got here and this is the way it's going to be."

More male respondents recommended changes such as providing more women faculty, offering more scholarships, influencing females in high school, and advertising than did female respondents. On the other hand, more females than males recommended changes such as influencing girl students in elementary schools through mentorship program and support groups as well as making curriculum more sensitive to female needs. The concern of females, therefore, is not so much directed at having more support as having a more *understanding support*, either through faculty, mentors, or support groups that can understand their interests better, or a curriculum that is more sensitive to their needs.

The suggestions of the students also showed certain racial/ethnic differences. Whites (15 percent) and blacks (19 percent) said hiring more women faculty would help make CS/CE programs more attractive to women, while none of the Asians thought so. Asians suggested that changes should be implemented more in terms of the material conditions, such as offering monetary help (10 percent) or supplementary and introductory courses (20 percent). For Hispanic students, the most important concerns were providing support groups (10 percent), doing better advertisement to attract more females (10 percent), and making changes in the curriculum (10 percent).

The responses of Hispanic students, as for students belonging to other racial/ethnic groups, have to be seen in light of their social background—Hispanic students (10 percent) were the only ones (apart from one American Indian) to say that their social background was an obstacle to pursuing a CS/CE career. A Hispanic male student explained that "for Hispanics, I'd say it's mostly just cultural. It's tough to say because, you know, I've worked with people out at [X] outreach programs and everything like that. And I mean, I remember it's like 40 percent Hispanic kids don't even graduate high school, much less even go on to college, much less even pursue a technical degree."

The social background that Hispanics saw as an obstacle was articulated as something particular to them. A Hispanic female said, "As a Hispanic, I would say that the way the race is, that family comes first, so there're times when I'm trying to study for a test or something and I get a call from my parents.... I have to, like, go home. See, that is one thing that is challenging; if you're a Hispanic, your parents teach you that your family comes first, regardless [of] whatever happens, you know, you have to be there." Similarly, an American Indian male said, "As far as, like, putting a computer language into use back home, like, say, if I'm from [X] I say the woman does not have the chance to put her knowledge to use in the [existing

American Indian] cultural context, so the value of knowing how to program is not there." What we again find, therefore, is that the habitus of students varies with regard to gender or race and ethnicity, and it affects their responses toward CS/CE education.

Conclusion and Implications

In this chapter, we have attempted to refine the debate over gender disparity and issues in CS/CE programs by showing how different social behaviors and experiences act dialectically in constituting a gendered environment in the programs, thereby affecting the perceptions of students and impacting their responses. The analytic framework of habitus that we have used here allows us to understand some key aspects of gender-related issues in CS/CE education. For example, the role of early socialization has been emphasized by many scholars; but the question arises, Why did the number of females who earned bachelor's degrees in computer science increase until 1985 and then decline?[4] Does this mean that gendered socialization during childhood and school did not have a significant impact until 1985? Our study shows that the impact of socialization is not redundant but instead becomes visible in the context of the present gendered environment in CS/CE, which in turn emerges in the first instance because the presence of females in these programs is seen as an anomaly.

It is also striking, as we have described in this chapter, that most students, males and females included, believe that there is no gender difference or that they do not remember any instances that remind them of being a woman in CS/CE programs, and yet their responses often have gendered connotations. Further, it seems intriguing that even though so many studies have emphasized that females suffer from a lack of confidence, which we found in our study too, an overwhelming majority of them told us that they thought they were as good as, if not better than, other male and females students.

An important implication of the theoretical framework that we have used here is that it allows us to understand the processual nature of the articulation of gendered perceptions in CS/CE programs. Past experiences, such as early gendered socialization, do have an impact, but they take prominence when they are articulated through and within the dialectic of the present gendered environment in CS/CE programs. Moreover, social actions do not take place independently of each other but are concatenated with each other, and the responses of students are based on their

dispositions, which constitute their habitus. Hence, even though females feel confident, the belief and experience of male chauvinistic behavior challenges their confidence, making them conscious of their being an anomaly within CS/CE programs.

Similarly, males most often said that they find that they are as good as other female and male students, and frequently praised the abilities of their female colleagues, but as we have shown in this chapter, they still often gave a gendered spin to the simple, everyday actions of females. The other important implication of our theoretical framework is that it makes it evident that the gendered and gendering issues within CS/CE programs cannot be seen or tackled as female problems because they are equally (or more) male problems. In fact, females' perceptions of themselves are intimately connected to what males think of females, which itself is concatenated with, and arises out of, several other factors that constitute the gendered environment of CS/CE programs and the habitus of the students.

As we have shown, there are several objective conditions, either in school (i.e., in CS/CE programs) or outside it, that critically impact the existing gender disparity in CS/CE programs. Through the concept of habitus, however, we have illustrated that more often than not, it is the subjective evaluation of these objective conditions that gives even simple, everyday actions or behaviors a gendered flavor, thereby further gendering social interactions within programs. The set of dispositions that constitute the habitus of students changes over time. But even as special measures are undertaken to recruit and retain more females in CS/CE programs, gendered perceptions and interactions may continue to exist. Hence, along with changes in objective conditions such as curriculum, advertisement, hiring more female mentors or faculty, and so on, there is a need to discuss these issues not only among academics and policymakers but also with students.

Our aim here has not been to offer new policy guidelines but to show how the policy guidelines can be refined and made more effective. This chapter shows that even though on the surface the responses of males and females as well as students belonging to different racial/ethnic groups may reveal some similarities, we have to be careful and analyze them in light of their habitus. For example, for a Hispanic, an Asian, a black, a white, or an American Indian student, social background constitutes different elements, and in order for the policies to be effective we have to be sensitive to these differences. To put it succinctly, in Dean John White's words, "If we want a different outcome, we're going to do things differently. We're making too little progress doing more of the same thing" (quoted in Cuny and Aspray, 2002, 168).

Acknowledgments

This research was supported by a grant from the National Science Foundation (EIA–0305898). We would like to thank all the interviewees, who gave us their valuable time, and Bhavana Upadhyaya, for assisting in the data analysis.

Notes

1. Existing studies have not made a distinction among different fields in science and engineering when assessing the underrepresentation of women. Margolis and Fisher (2002) have done an empirical study specific to computer science at the Carnegie Mellon University on this issue. Their study, however, does not have a diverse representation of women, especially minority women.

2. This racial/ethnic classification is similar to that used by the National Science Foundation.

3. There has been a particular line of study in the social sciences that following Georg Simmel (1950), has attempted to analyze the significance of numbers in social life and show how "numerical modifications effect quantitative transformations in group interaction" (Kanter 1977, 965).

4. The number of females earning bachelor's degrees in computer science increased from 2,463 to 14,431 between 1979 and 1985, and then steadily declined to 7,063 in 1995. From 1995 on, the number of females earning bachelor's degrees in computer science steadily increased, but by 2000 it was still below the 1985 mark (National Science Board 2004, 2–23).

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