Examining the Gender of Women in Science and Engineering

WGS.110
Women and Science

Discrepancies in the education of men and women have existed in the western world for thousands of years. Traditionally men have been privilege to the education and respect granted to the professionals of any culture while women have traditionally been restricted from acquiring knowledge or occupying positions of influence. While this inequality can be traced back to the ancient world where it was represented in law, in the contemporary world the causes of such divisions lay quietly masked in cultural expectations. While people generally seem unwilling to dispute the equality of men and women, it is unarguable that different expectations for the roles of men and women are deep-set in American culture.

Generally when people describe ‘equality’ among individuals or different peoples, they are referring to an intangible quality that ties the human race together; very rarely do people consider specific situations. Much like the ‘separate but equal’ mentality that defined segregationist politics in the first half of the twentieth century, people consider the roles of men and women in society to be distinct, though equally important. This is especially true in cases of education. Again, although no one would deny the importance of educating women through high school and college, the professionalism and academics of men have been taken far more seriously in the past fifty years than those of women through every step of the American education system. Although great progress has been made, with the number of women receiving bachelor’s degrees in science and engineering (S/E) fields having quadrupled since 1966, stereotypes concerning the roles of women still abound, and there is great stigma surrounding women who choose to involve themselves heavily in their professional careers. It is interesting to note that
while all fields of academic study have gained appreciable numbers of women in their ranks, S/E disciplines have been the slowest to gain these numbers.

In Jacob Hale’s essay, *Are Lesbians Women?* Hale examines this question by outlining a series of qualifications that are used daily in the identification of women. These qualifications describe the physical and psychological attributes an individual need possess to be deemed ‘woman’ in contemporary American society. Despite the fact that ‘woman’ usually indicates a biological status marked by an XX chromosomal genotype and the development of primary secondary-sex characteristics, society requires that an individual maintain certain personality traits as well to justify the title ‘woman’. Thus, I divide the qualifications that Hale presents into two categories. The first category includes the biological physical traits, including the presence of reproductive organs and XX genotype. These characteristics are almost always objective qualities that are present from birth or develop naturally, without external influence. The latter set of characteristics describes the gender roles associated with womanhood, including acceptable occupations, the fulfillment of domestic responsibilities, and expressing deference to men. These latter characteristics I would call femininity, and can be markers of an individual’s female gender.

If not directly educated by our parents, inundation by the media makes us aware of these societal expectations from a very young age. As women have gained increasing presence in professional workforces, the acceptable bounds for what is considered feminine have been altered. Women in fields of S/E, however, are still working to gain cultural acceptance. This is because math and science have long been considered ‘masculine’ pursuits, with some researchers going so far as to publish articles ‘proving’
that a boy’s academic strength lies in analytical disciplines while a girl’s strengths are in humanistic studies. Culturally, ‘intelligent’ women are not expected to excel in S/E, or to have an interest in S/E disciplines. Women who engage in these pursuits are often seen in a negative light, lacking feminine attributes, or possessing masculine ones. This is not the case for men, where an adroit handling of math and science is expected for an intellectual.

The cause of this is the perception that attributes like ‘intelligence’ and ‘mathematical capability’ are inherently gendered characteristics. Although most characteristics have broken from gender stereotypes, mathematical capacity is still widely seen as a masculine attribute. This same reasoning applies to the fields of S/E, especially past the high school level. A fact that goes to support this perception is the relatively low numbers of women actively involved in these fields. In past literature this has been modeled as a ‘pipeline’ whereby women and men must commit to and accomplish specific benchmarks to progress in their science education. This track can begin as early as the pre-school years when boys are challenged with mechanical or analytical toys, and girls are given dolls to play with. At any time in the education of an individual she can exit the ‘pipeline’ and never return to it, terminating her chances to enter fields of S/E.

The pipeline model is effective because of the specificity and difficulty inherent in S/E coursework, in addition to the unique culture and attitude that is concomitant with an education and career in S/E. Women at MIT have effectively remained in the pipeline long enough to begin their undergraduate careers in S/E. I am very curious as to what (if anything) makes these women different than women elsewhere- especially those of equal intelligence who have ‘exited the pipeline’ prematurely.
Considering that high intelligence is not requisite for an interest in S/E, and that anatomically women at MIT are no different than women elsewhere, I am inclined to believe that women at MIT (and possibly other technical institutions) have a unique consideration of their gender. I believe this because normative gender identification as ‘female’, as outlined in Hale’s essay, is in direct conflict with an interest or capacity in S/E fields. It is my observation and hypothesis that women in S/E rationalize their unique position by either taking on a non-normative feminine identity, or by self-identifying with stereotypical masculine characteristics. In the first case a woman may consider herself to be completely female but will have adopted a non-normative basis for femininity. In the latter case, a woman will probably consider herself mostly feminine, but will maintain that she possesses certain masculine characteristics. In either case, I would expect women to notice a disparity between their femininity and the femininity of women in more traditional (socially accepted) roles.

My study is not unique, and many researchers have sought to answer these same questions. How women in scientific fields define their gender is an important topic that can elucidate the more pressing matter of the notable dearth of women in S/E. The research of Kim Thomas in *Gender and Subject in Higher Education* examines this problem in English Universities. Specifically, the study targets male and female physics students at the university level, trying to ascertain differences in their approach to studying physics, and their comfort with the university atmosphere.

Specifically, the women are very aware of their minority status, and numerically, this is not surprising, with women constituting as little as 5 in 200 for a given physics class. Women in this environment tried to exaggerate their feminine identity by acting
out in stereotypical ways. Oftentimes women would ask men in their classes for assistance in order to feel more included in the class atmosphere, and perhaps to put the men at ease. It seems that women in S/E must develop unique expressions of their gender to be comfortable in their position.

Survey

As part of my study I composed a survey (attached) asking for self-identifying women to provide information concerning their femininity and masculinity, and how they would compare themselves in these terms to other women at Boston area schools. I tried to remain unbiased, structuring the survey as to allow for open ended answers, and unique non-normative definitions of femininity and masculinity, including a non-definition, or a rejection of the concepts. This was accomplished by allowing participants to define what they believed to be feminine and masculine characteristics. Specifically, I targeted women at Boston College, Boston University, Harvard University, MIT and Wellesley College. I circulated the survey by sending it to friends of mine at those respective schools and asking them to forward it to their friends. In a way, this may have biased my results, but I was successful in attaining responses from individuals I didn’t know, and from individuals outside my direct social sphere. Although my results were limited to 24 responses, I feel like the data I received reveals a few striking characteristics about how women at MIT think about their gender.

The responses I received were divided in the following proportions: 18 from MIT, 1 from Boston University, 4 from Wellesley College, and 1 from Boston College. I originally sought responses from women at schools other than MIT in order to
accumulate responses from S/E majors at other schools, and from non-S/E majors. The miniscule response I received makes analysis using these sources difficult. However, these individual responses are still important, I believe, as being distinctly different from any of the MIT responses I received. In fact, over the range of responses from MIT students, the few from non-MIT students are in direct contrast and can be used as foils to further expose the attitudes of women at MIT.

In drafting the survey, I believe I created it in a highly open-ended fashion, not prompting participants to respond in any specific way. This way, I hoped to allow women to answer as freely as possible, and to gather the most informative responses concerning their self-identity. Responses indicated two aspects of femininity in different proportions- how a woman thinks about her own femininity, and how a woman perceives social norms considering femininity. I was not very surprised to see that almost every response made some reference to one of Hale’s qualifications of femininity. Whether or not the responder took that qualification to heart, it was clear that she was aware of it, and had the capacity to think of herself in those terms, and compare herself in those terms, without necessarily believing those terms to be necessary for femininity. This result is very important as it indicates the degree to which society is permeated with information pertaining to the social expectations of women.

One of the most prominent aspects of the responses is the immediacy with which respondents associated femininity with womanhood. Gender is a quality separate from biology that is defined by personality traits and modes of socialization, among other things, leading to the gender identity female, but not necessarily to the biological identity woman. Many responses made a direct correlation between the two citing physical
characteristics like breasts, a monthly period, a petite build, female reproductive organs, female hormones, and an XX genotype in their definition of femininity.

The MIT respondents in their recognition of social standards cited numerous characteristics of femininity that fit in with Hale’s qualifications. These included tendencies to be emotional, self-aware, sensitive, ‘moody’, cooperative, compromising, lacking technical skills, and effective listeners. Masculine characteristics, on the other hand, included being forward, opinionated, of a strong character, confident, stoic, focused and ‘engineering oriented’. It is interesting to note that while all respondents defined femininity using at least a few of these characteristics, that awareness did not correlate at all to self-definition by those standards.

To model the responses, I will describe what I consider to be three separate archetypical responses. Each actual response could be composed of these idealized responses in varied proportions. The most general response is one that both recognizes and accepts the socially defined qualifications. This respondent finds ways to describe herself within the context of Hale’s discourse, either by conforming to feminine standards, or seeking to conform through change. The second type redefines femininity, either by borrowing select attributes of socially accepted femininity, or by creating a femininity entirely to fit her self-identification. This is the most common type of response. The third response, and the most difficult to interpret, is the complete disavowal of gender or gender differences. I consider this to be a highly intellectualized response that may be the result of study in particular fields including psychology, queer studies, or anthropology, and may not be as present in a less academic population.
In trying to divide the response into one of the three categories, I noticed a distinct difference to how women perceived their femininity when asked to rank it on a scale from 1 to 10. The subjectivity of this question was important in measuring how women compared themselves to some absolute standard. Women who only described femininity in terms of normative attributes rated themselves lower than women who used non-normative characteristics to define their femininity. Women who rated themselves as 5 or lower described femininity solely in normative terms, while women who rated themselves as 7 or higher, although they may have acknowledged stereotypical expectations, also defined unique characteristics. Stereotypical response maintained cultural stereotypes by citing appearance, politeness, or ‘softness’ as primary feminine characteristics. Non-normative responses, however, introduced new attributes that either lay outside of the normal spectrum (i.e., usually non-gendered terms becoming gendered), or were distinctly masculine (i.e., strength). These included creativity, patience, awareness, and confidence. In general, women did not seem self-conscious of maintaining these non-normative attributes, having adopted them into their primary definition of femininity.

One MIT student is a prime example of redefining femininity away from cultural stereotypes. In addition to describing her femininity in terms of her propensity for shopping for clothes and being concerned with her appearance, she also noted ‘being good with power tools’ among her feminine characteristics. In addition, she rated her femininity as 9. This is representative of the gender response of many MIT students I believe.
I was interested to note that even for the women who defined unique characteristics to describe their femininity, very few rated themselves as 10. Despite the invitation to define femininity in any manner she felt most comfortable with, and finding unique and non-normative ways to do so, every woman but three expressed incompleteness with their femininity. I base this conclusion on the assertion that the respondents consider their gender to be primarily feminine (if at all), and thus, if being in a position to define femininity, should rank themselves consistently as 10. However, it would seem as though women, in being aware of social standards for femininity, adopt some of these standards in addition to their own unique attributes. This is surprising, and at the same time, not. It is surprising that women with such independent perspectives on femininity should still be subject to social pressures, but at the same time, it seems difficult not to be while living in a society inundated with influences to that effect. Another interpretation of this result is that these women actively define themselves as both masculine and feminine. For a woman who rates her femininity below 10, and who is comfortable with her gender, it is possible that she has incorporated masculine attributes into her gender identity. This theory is supported by the fact that many women asserted that they possessed masculine characteristics. Distinguishing between these two possibilities would be assisted by knowing more precisely how a woman feels about her masculinity. This aspect could have been elucidated by asking for each women to rate her masculinity as well as her femininity. This would have clarified whether a rating of 7 for femininity, for example, indicated a lack of femininity, or the existence of masculine characteristics.
Perhaps the most optimistic and positive part of the responses was that not a single woman felt discouraged by her position at MIT (or anywhere else, for that matter), and two women, in fact, felt encouraged by the unique opportunity they were presented with as women in fields traditionally dominated by men. While this may not be representative of women receiving scientific or technical degrees at other universities, MIT has created an environment where women have been able to find support and security in their pursuit of a scientific education. MIT has admitted women since its inception, so in some regard, this has never been a novel adjustment. One respondent summarized the confidence women at MIT feel by saying, ‘The talented are rewarded, regardless of gender’.

That women are so optimistic and confident at MIT is inspiring, but I am forced to wonder whether the sense of meritocracy and egalitarianism that pervades campus has made students naïve. The proportion of men to women in MIT’s undergraduate population is around 55% to 45%, and as recently as 2001 the proportion of men to women obtaining graduate degrees in S/E fields was only 63% to 37%, and. Going one step farther, it is almost alarming to note that the proportion of men to women with doctorates employed in S/E fields is only 74% to 26%. It is interesting to note that the number of Bachelor’s degrees awarded to men and women in S/E fields is approximately equal. Why women leave the pipeline after having come so far is an important question. Women at MIT obviously don’t feel intimidated by these facts (nor should they be), but there is a substantial and outstanding gap between the lives of men and women in S/E fields. This discrepancy may, however, be completely absent at MIT. It may be at other
universities across the country, where women are not as well integrated in the S/E culture that they exit the pipeline before their male counterparts.

Although women feel insulated at MIT, responses made it clear that contact with other colleges and universities make women feel lacking concerning their femininity. Again, despite being able to define unique perspectives on femininity that allow them to perform well in S/E disciplines with confidence, women at MIT are completely aware of stereotypical femininity. A large majority of respondents ranked Wellesley College as first on their list of schools exhibiting femininity, and rated MIT last. Boston College was the second choice for a majority of respondents. That Wellesley was a first choice was telling, as I have personally heard women at MIT compare themselves negatively to women at Wellesley on numerous occasions. One respondent made this very clear in the survey stating, ‘Girls at other schools tend to look so beautiful!’. This suggests that while women may have found ways to live comfortably with their own gender attributes, they do not see these as being universal, and continue to perceive the outside world with socially constructed expectations.

I have observed through these surveys that women in science and engineering disciplines are well aware of the gender stereotypes that pervade American culture. In order to remain confident and unfazed by the pressures against women in S/E disciplines, women tend to redefine femininity in terms of characteristics that they possess, either by defining their femininity through non-normative characteristics or by defining femininity in terms of traditionally masculine characteristics. In another regard, women tend to face this issue by disregarding the question of femininity vs. masculinity entirely, and maintaining a neutral attitude. Whatever the case, women at MIT seem effectively aware
of their gender and the genders of others, but have found a community where they are allowed to express their gender in non-normative standards comfortably.

As an aside, if I were to continue this study I believe it would be important to examine why women are pursuing degrees in S/E. I would also give this survey to men to answer, as I think their responses could be telling with regards to how women feel around groups of men.

**Conclusion**

In *Toward a Theory of Gender* by Suzanne Kessler, the author examines how people attribute gender to physical cues. She constructs a game whereby a picture can be drawn that presents different, conflicting physical attributes simultaneously, and participants are asked to identify the image displayed as male or female. She finds that in identifying women, participants in a survey require substantially more physical ‘evidence’ than they do for men. For example, while the presence of a penis is almost always enough for an image to receive the designation male, despite the presence of breasts and hips, the designation of woman is only achieved with the recognition of multiple female attributes. Similarly, respondents to the survey mentioned a series of physical characteristics that define femininity. Among them being reproductive organs, long hair, wide hips, breasts, and female facial features. While not all respondents mentioned physical appearance, those that did tended to mention a series of characteristics including secondary sexual characteristics. This is very interesting when compared to the way respondents described masculinity in terms of physical attributes limited to penis and musculature. Asked if there were any reason a respondent would
want to conceal their gender, a few respondents wrote that they would ‘hide their breasts’, displaying an awareness of the physical characteristics that define women in a social context. The importance placed on secondary sexual characteristics to determine gender is not a factor shared by men, and presents a unique issue to understanding women’s gender.

In this way, physical characteristics, because of their prominence, become a central issue in the definition of female gender. This is a central reason, I believe, to why gender roles are more tightly regulated for women, and why women are more prone to feeling pressure in relation to their gender presentation.

Having analyzed this series of surveys, a wide spectrum of traits defining masculinity and femininity were presented, and I am hard pressed to define any characteristic as masculine or feminine. The women I have contacted have provided a unique perspective on women in science and engineering. The femininity of women in these disciplines is more fluid and less constrained by societal expectations. Women in science and engineering disciplines have found ways to excel despite social pressures by redefining their femininity and moving away from the restrictive social stereotypes as described by Hale.
References


Age:
Year:
Race:
Major:
Institution:
Sexual Orientation:
Gender:

Please answer the following questions in as much detail as you can. Answer them from a personal perspective, and consider each question as it pertains to you. Note, that some questions may not be applicable to all:

What do you believe are feminine characteristics?

What do you believe are your most feminine characteristics?

What defines you most as a woman?

Rate your femininity from 1-10 (10 being ‘most feminine’):

How do you compare yourself to women at other schools in Boston?

Please rank the following schools in order of femininity (1 is highest):
- Harvard
- Boston University
- Wellesley
- MIT
- Boston College

Do you perceive yourself to be more or less feminine than students at the following schools:
- Harvard
- Boston University
- Wellesley
- MIT
- Boston College
Is there anything as it pertains to your femininity that you would change, to become either more or less feminine? Why?

Do you ever seek to conceal these physical or psychological attributes for any reasons?

If yes, what reasons?

How often do you think about your own femininity?

What do you believe are important masculine characteristics?

Do you possess any masculine characteristics?

Do you ever seek to conceal these attributes for any reasons? If yes, what reasons?

How did you choose your current area of study?

Do you feel like the most prominent professionals of your field are of a specific gender? If yes, which?

Does that fact encourage/discourage you, or are you unaffected by it?