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Talking Nerdy: The Invisibility of Female Computer Nerds in Popular Culture and the Subsequent Fewer Number of Women and Girls in the Computer Sciences

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Abstract

The male computer nerd is a trope found often in popular culture. Both reflecting and sustaining the values of a masculinized culture of computing, he is found in a variety of media formats and easily recognizable. It seems no coincidence then that the large majority of people entering into the computer sciences are male. Naturalized social and cultural assumptions regarding gender and ability contribute to the belief that men belong in front of the screen and make invisible gifted and passionate computing women. Highlighting the previously unseen and undervalued female computer nerd and examining the strengths women bring to the computer sciences while at the same time deconstructing the groundless gendered beliefs that mask the existence of female computer nerds can help bring about necessary legitimacy. Using the television show The Big Bang Theory to demonstrate the complete dominance of the male nerd within pop culture as well as the limited positions granted to computing women, it can be argued that the lack of a socially supported position for nerdy girls and women contributes to fewer numbers of females in the computer sciences.

Keywords: nerds, gender and technology, women and computers, culture of computing

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The archetypal computer nerd is common in pop culture. He wears glasses, sports oddly parted hair, and is a genius in front of the screen. He is also only male. The lack of a female equivalent results in a lack of cultural framework to understand and place women who have an interest and excel in the computer sciences. It also means that the culture of computing, the norms and assumptions that have arisen alongside the reliance on computers, comes solely from a male standpoint. This absence of female computer nerds from social consciousness, together with additional factors, can help explain both the proportionally lower numbers of women entering into computer science fields as well as why the current culture of computing may turn off potentially interested women.

While the computer nerd is a well-known trope and can be found in a variety of media formats from books to big budget movies, the television show *The Big Bang Theory* seems especially popular. In it four young men with advanced degrees in scientific fields navigate everyday life. The show is meant to be humorous and the majority of jokes seem to center on their social awkwardness and interactions with their good-looking neighbor who comes to represent the normal, non-nerdy majority of society. *The Big Bang Theory* thus becomes ideal for examining

the social construction of nerdism. The stories are told from the perspectives of the nerds and clear bounds are drawn between them and the so-called regular people. From the appearance of the characters and the events that unfold it becomes abundantly clear just how masculinized computer culture is and how the word *nerd* carries an implicitly male connotation. The presentation of computer nerds as male as well as the masculinization of computer culture can help to explain the disproportionately low number of female computer nerds by demonstrating that such a role does not fully exist in acceptable popular culture.

Nerdism and Masculinity

The very definition of a computer nerd seems representative of masculine values. The word nerd itself has been around since the 1960s and from the beginning was used to describe a solitary person who worked with numbers and had a near obsessive interest in technology (Gershuny, 2003, p. 141). Since that time the word has continued to represent a socially awkward person though its overall meaning has expanded. Near synonymous with the word 'geek', a nerd can be understood as a "young man who is pasty, badly dressed, poorly groomed, has few friends, and loves Star Trek, violent video games, and, most of all, computers" (Tobin, 2011, p. 504). They can be, but are not always, academically successful and have no time for dates and parties due to their allegiance to school (Bracey, 1993, p. 734). Nerds are further assumed boring, dull, unattractive and avid participants in mathematics and the sciences. This cultural understanding feeds into the comically gauche representation of the nerdy characters on *The Big Bang Theory*. All four, Sheldon, Howard, Leonard and Raj, work as university researchers in math-based subjects, wear bright, fashionably awkward clothes, and spend much of their free time at a comic book store (Lorre, Prady *et. al.* 2007-08, Season 2 Episode 20). While they maintain a close bond with each other they have trouble interacting with non-nerds, which is exemplified by their comically gauche relationship with their blonde, beautiful non-nerdy neighbor (Lorre, Prady *et. al.* 2007-08, Season 1 Episode 1).

Exploring the role further, Lori Kendall writes that while embodying the qualities of a nerd reduces sexual attractiveness, the overt masculinization of nerd values like intelligence and computers skills allow for the retention of a male sexual identity (2000, p. 262). This obscures any socially viable connection between female nerds and female sexuality, effectively erasing them from social thought. In Kendall's study she found that male nerds presumed women who attend science fiction conventions, and therefore could arguably be termed female nerds, as undesirable (p. 266). The sexual attractiveness of female nerds was reduced because they occupied a space not their own and therefore did not conform to the norms of femininity. Such a character, Leslie, exists on *The Big Bang Theory* and is marked as unfeminine through her masculine clothes, dry wit and utter lack of flirtatious graces (Lorre, Prady *et. al.* 2008-09, Season 2 Episode 16). Though somewhat friendly with the female-starved central characters, she is not openly desired by any of them until she makes her sexual availability known. Race too plays an interesting role in the construction of nerdism. While certainly male nerds of non-white ethnicities exist, in North America the dominant trope is of a white man (2000, p. 266). The push and pull between race and nerdism is also exemplified through a male character of Indian descent on *The Big Bang Theory*. While 'Raj' is certainly accepted among his white nerd friends, viewers are constantly reminded of his ethnicity through his thick accent and references to his culture of birth (Lorre, Prady *et. al.* 2007-08, Season 1 Episode 8). He therefore becomes, for lack of a better phrase, a nerd on the margins.

Given the extent to which technology is used and relied upon in our society, technically savvy nerds can occupy both a respected and undesirable space depending upon the social context (Kendall, 2000, p. 262). Nerds are both relied upon for their knowledge and ostracized for their

non-conformity to dominant social values. Within a community of nerds computer skills and fitting the otherwise objectionable stereotype of the computer nerd can be a positive. Among the four main characters on *The Big Bang Theory*, Sheldon, the most intelligent of the group, is mocked by his fellow nerds yet accepted and revered for his superior knowledge. In one episode Sheldon wins a National Science Foundation grant to detect magnetic monopoles in the North Pole. Despite being an incredibly prestigious and exciting trip, the entire episode is devoted to Howard, Leonard and Raj pitting their abhorrence at having to spend three months in isolation with Sheldon against their desire to be a part of his science experiment (Lorre, Prady *et. al.* 2008-09, Season 2 Episode 23). Nerds, by virtue of their technical expertise, are necessary and thus can be grudgingly admired for their intelligence from within the margins of dominant, socially acceptable society. Their desire to maintain an extreme level of technical knowledge may in fact be a means to restore power lost through their outsider position within mainstream culture (Kendall, 2000, p. 262).

For female nerds then, this results in a double removal. Not only are they in opposition to dominant society through their adoption of nerd values, they cannot find acceptance from a nerd standpoint given the unacceptability of their gender. This lack of supportive representation both in mainstream and outsider society results in the non-existence of an acceptable version of a female nerd. Socialized in other directions, it makes it all the more difficult for women with genuine interests and talent in the computer sciences to find their footing and fully enter into this masculinized field.

The representation of the stereotypical anti-social male computer nerd is perpetuated by assumptions of their technical savvy made by dominant culture (Kendall, 2000, p. 280). It has further been determined by Allen and Thomas (2006), among others, that the media, particularly pop culture movies and television, is the second most influential source of computer nerd perceptions. Thus, the lack of positive, supportive representations of female computer nerds on *The Big Bang Theory* adds to beliefs about the nonexistence and overall undesirability of female nerds. This absence of technically skilled women is furthered by a lack of representations in other forms of media. Magazines aimed at women, for example, contain very little content on computers (2006). Again this works to normalize the computer sciences as a male space and thus women entering into this field is synonymous with culturally deviant behavior. Disturbing as it is, this makes examining *The Big Bang Theory* appear all the more representational of how women are treated within computer nerd culture.

Of demonstrating a more positive television representation of female nerds and nerds in general, Allen and Thomas write that “it would be great if the character doesn’t follow the ‘geek’ stereotype of a skinny male with glasses…women characters are hardly ever shown in movies or television, and when they are presented, they are portrayed in an unfavorable manner (2006, p. 167). This parallels the representation of Dr. Leslie Winkle, initially the sole female nerd on *The Big Bang Theory*. Leslie is shown as consistently cold and unfeminine, callously ending her relationship with Howard and breaking his heart (Lorre, Prady *et. al.* 2008-09, Season 2 Episode 21). That she is so unfeeling and, with large glasses and baggy clothes, so far from the normative representation of a sexy woman suggests that in order to be in her field she must shed all semblances of femininity. Given the pervasiveness of the media in forming dominant culture’s perception of nerds, Leslie’s characterization suggests that women must put on masculinity in order to be successful in the field of physics. This assumption and the lack of representation of positive, feminine computer nerds on television could play a role in discouraging women from pursuing the computer sciences.

In later seasons, two more potentially nerdy female characters are introduced on *The Big Bang*

Theory as potential love interests for Howard and Sheldon. Bernadette is a biology graduate student who eventually earns her PhD, and Amy is a practicing neuroscience researcher who has already received her doctorate. At first glance the addition of these obviously smart and capable female characters appear as equally brilliant counterpoints to their nerdy male mates, and seem to result in a much needed, more balanced representation of female nerds. However, if maintaining that Penny stands as the touchstone of feminine desirability and the ideal figure of male sexual fantasy, a comparison of her to Amy and Bernadette, as well as to what male nerdiness looks like, reveals some interesting counterpoints.

The character of Bernadette for instance is hyper-feminized. She is small in stature, is often shown wearing bright, poufy dresses with cardigans, has a high-pitched voice and frequently puts a bow or headband in her blonde, wavy hair (Lorre, Prady *et. al.* 2010-11, Season 4 Episode 23). Her ultra-conformity to the norms of femininity is juxtaposed against her scientific work. She often makes jokes about the deadly bacteria she encounters (Lorre, Prady *et. al.* 2010-11, Season 4 Episode 5), yet she remains a safe, non gender-bending character because she embodies such extreme girliness. It could be argued that Bernadette represents the previously invisible female nerd; however, because the marked difference between her femininity and her scientific, nerdy talents is continuously created as a source of humour, it works to delegitimize the obvious brilliance she demonstrates in her masculinized field. That there is something incongruously funny about a woman in a laboratory fuels the established belief that nerdism and scientific pursuits are exclusively male.

The character of Amy also works to confirm the world of nerds a masculine space. Akin to Leslie, the initial female nerd on *The Big Bang Theory,* Amy represents somebody who has tried, but blatantly failed, to adhere to any sort of idealized femininity. While she sometimes wears skirts, Amy is consistently dressed frumpily, is ungraceful, and jovially pragmatic to the point of annoying the other characters (Lorre, Prady *et. al.* 2010-11, Season 4 Episode 3). What makes Amy's character so demonstrative of how socially unnatural it appears for a female to exist within the masculinized world of science and technology can be understood best through her relationship with Penny. She constantly compliments Penny on her good looks and makes a point of announcing her forgiveness of Penny's foibles due to her beauty and charm (Lorre, Prady *et. al.* 2011-12, Season 5 Episode 17). When Bernadette tries on wedding dresses with Amy and Penny, Amy makes a point of declaring Bernadette pretty, but not Penny pretty (Lorre, Prady *et. al.* 2011-12, Season 5 Episode 8). Both Bernadette and Amy, as female nerd characters, demonstrate how gender is negotiated within the masculinized world of science, yet ultimately come to represent safe, cultural creations that adhere to, rather than challenge, established gender identities. Neither character, one sickeningly feminine and the other seemingly genderless, really offer any kind of positive representation of female nerds.

The Culture of Computing

Along with the construction of computer nerds, the subculture in which they function and find success embodies masculine values. Having now established what a computer nerd is, it seems necessary to describe the space they inhabit. Hapnes and Rasmussen define computer culture as that which supports a "machine fascination and interest in the possibilities of computers; work addiction and total absorption in computers; [and] a playful attitude towards the computers" (1998, p. 391). In *The Big Bang Theory* computers infuse all aspects of the nerds' lives. During one episode they install a high tech camera outside Penny's apartment door and hook it up to their computers so that they can spy on her interactions with Leonard and determine how he can better win her affections (Lorre, Prady *et. al.* 2008-09, Season 2 Episode 1). Computer culture is entirely centered on the use of computers, often to the detriment of

other aspects of life. This is embodied by a somewhat chilling description of an office in Silicon Valley fully equipped with beds, workout equipment and direct access to takeout restaurants (Fisher & Margolis, 2002, p. 67). Taking part in the culture of computing is therefore not something that one does part time or on the weekend but means fully subscribing to values that overwrite and clearly oppose those perpetuated by dominant culture, like having a social life. Fisher and Margolis refer to this complete absorption as "dreaming in code" (p. 5), implying that even in sleep computing remains the number one priority. For computing women then, it means entering into computer culture and attempting to achieve success by adopting all of the aforementioned characteristics that comprise it. It means adhering to different values and, as further examination will reveal, putting on a masculine identity.

Given that the computer nerd is a masculinized identity, it follows that the computer culture that produced it also reflects predominantly masculine values. For women desiring to enter into the computer sciences, this can result in a clash of beliefs and expectations. Problems result from the assumed polarization of masculine and feminine attitudes. Men are assumed one thing and women the naturalized opposite. As men are perceived to be experts with computers, women are assumed computer illiterate. Sue Clegg explains that computer culture is reproduced as masculine through everyday occurrences and that the relationship shared between "a particular historically given form of masculinity and the shape and form of a technology (as opposed to underlying physical properties of the material world which make its operation possible) is therefore historically contingent" (2001, p. 317). Computer culture is reflective of masculine values because it has been socially created to be so rather than from any sort of intrinsic means.

For women this can make it difficult to enter and find representation in the computer sciences. Despite that women are not inherently less gifted than men, the dominant computer culture does not give room for their experiences. So too is this division reflected in the fields of computer science. According to Ruth Oldenziel, it is presumed that "men design systems and women use them, men build bridges and women cross them" (2001, p. 128). The already ingrained assumption that men are somehow better at computers automatically positions women outside of dominant computer culture. This results in women having to choose to conform to existing values and hopefully find success or else to remain on the margins. Women can never be fully-fledged computer nerds and thus the culture of computers will never be able to fully reflect and sustain their needs. Regardless of whether women choose to conform or remain outsiders in a hyper-masculinized field, their sex guarantees they will experience some degree of marginalization.

Given this naturalized exclusion, where women do not seem to fit into the computing culture and often choose not to follow the lifestyle of the nerd, it does not necessarily mean they share no interest in the potential of computers. It might be more likely that they cannot imagine themselves operating fully within that space. When women are rejected solely for the naturalized connections between their biology and the presumed associated characteristics, a typical response seems to be a distancing of self from all things feminine. The science loving female characters on *The Big Bang Theory* continually demonstrate this response. Leslie Winkle is constantly shown to have rejected standards forms of femininity. She is completely frank about her sexuality and propositions Leonard dryly and without any hint of feminine charm (Lorre, Prady *et. al.* 2007-08, Season 1 Episode 5). Leslie also makes it clear to him that she is not interested in any sort of relationship and only used him to satisfy her sex drive. In a later episode when Leslie and Leonard eventually do begin a relationship, she is presumed by Howard, Sheldon, and Raj to assume the role of the man in that coupling. Amy is also quite upfront about her sex life and is the main instigator in her relationship with Sheldon (Lorre,

Prady *et. al.* 2011-12, Season 5 Episode 10). It is as though in order to belong in the world of computer science Amy must ape overtly masculine traits and behaviors.

Gender and Computer Use

The masculinization of computer culture and the notion that men are inherently better at computers by virtue of their biological sex is perpetuated through gender socialization. Overall, men are assumed to love computers more. It is this love that makes choosing a career in the computer sciences a simple decision that becomes an extension of their hobby (Fisher & Margolis, 2002, p. 49). Men recall having "an early, sizzling attraction to the computer" (p. 16). Studies have shown that, in contrast to an immediate and passionate response, women who love spending time on the computer view their attraction as one thing they enjoy doing among many. This apparent difference fuels the belief that men are simply built to use and enjoy computers more while women take them much less seriously. As a result, this fuels the naturalized assumption that men belong with computers and gives would-be female computer nerds little room to represent themselves within male computer culture.

Furthering the acceptable socialization of men into the world of computers, men also describe being able to have more fun in front of screen than women do. In a particular study looking at the use of computers in a math classroom, "boys were most likely to respond to questions or display behaviors and express opinions from which it could be inferred that computers were a source of pleasure in mathematics lessons" (Leder & Vale, 2004, p. 301). This disparity arguably demonstrates the greater social acceptance boys have in front of the computer screen. Male computer nerds immensely enjoying the time spent on their computers are the norm whereas women, perhaps made more uncomfortable due to the socialization process that presumes computing a male activity, were less able to enjoy time spent on the computer. In the same study, the male students were also reported to use the computers for other tasks like gaming much more than the women (p. 301). This seems to showcase the acceptability for men to explore their love of computers and that the cultural norms that promote their interest in computers result in a greater deal of machine comfort. It does not mean that women do not enjoy computing, only that they can find it very difficult to feel fully welcomed and supported in this male space.

The different ways men and women are assumed to use computers are demonstrated in many varied situations on *The Big Bang Theory*. Overtly representing the break between masculine and feminine, in one particular scene Penny is shown using a hot pink computer whereas Leonard types away on a computer that is grey, red, and covered with science fiction stickers (Lorre, Prady *et. al.* 2008-09, Season 2 Episode 16). The male and female interactions with the computers seem also to support gendered stereotypes. When Penny's computer stops working while she is shopping for shoes, she runs to Leonard to help her fix it. Her use of technology aids in the production of herself as feminine through facilitating her desire to own and put on vestments of femininity. Leonard, on the other hand, is shown as knowledgeable in masculinized technology and is able to come to her rescue.

In another instance Penny takes the initiative to start her own hair jewelry business and asks Sheldon for friendly advice. When hearing of her plans the other nerds join in and completely take over production. Leonard ends up creating an elaborate website in which to showcase Penny's designs, demonstrating both his prowess on the computer while the others share their knowledge of business and economics (Lorre, Prady *et. al.* 2008-09, Season 2 Episode 18). This interaction clearly follows gender norms. Penny is shown as expressing her creativity through designing a feminine hair barrette and the men take over the intellectual side of her endeavor by utilizing their technological talent. Here, as well as in the earlier instances described,

computers on *The Big Bang Theory* are shown as masculine objects as well the centerpiece for interactions that support gendered stereotypes.

Early and Continued Exclusion

The socialization process that creates the male computer nerd and presumes computer culture a masculine space begins, often unintentionally, in childhood. Computing is coded as 'guy stuff', making young girls passive users (Fisher & Margolis, 2002, p. 4). Gender norms and computer norms become cyclical. Young boys see their fathers and brothers tinkering on the computer and wish to join in (p. 22). Therefore, beginning with use in the home, computers are treated as a male object and thus computer culture becomes masculinized before a child can begin any serious study or employment. A computer can also be marked as male through its physical placement in the family home. Fisher and Margolis describe speaking to one woman who had a great interest in computers. Despite that both her parents were in the field of computer science and should have recognized her passion, the family computer was placed in her brother's room (p. 22). This may not have been an intentional message declaring that girls do not belong on the computer, but stands as another example of how parents can reinforce and reproduce gendered stereotypes without meaning to.

Fisher and Margolis (2002) explain that parents buy toys for their children that they believe they will like and make the assumption that boys will use and enjoy computers more (pp. 23-24). The overlooking of young girls who have an interest in computing seems to result from blinding social norms. With the creation of computers as a male space there comes the assumption that females wishing to occupy it are somehow deviant. Fisher and Margolis also describe the experiences of one computer-keen girl who recalled her family's disapproval of her interests. She remembers being told that she "was not supposed to be interested in that type of thing and that shouldn't be so important or interesting to you" (p. 30). So rigid are the social norms that create computers as male that a female is thought to be misbehaving or acting out of her real character if she expresses an interest in computers. This kind of attitude and socialization equally supports male nerds and undermines the female equivalent. Opposing expectations of what girls and boys should be doing creates a pattern of assumptions that carry through to postsecondary studies and employment. The male roots of computer culture run deep, thus accounting for some of the problems women face in trying to enter that particular space as well as the disproportionate number of women who actually succeed within it.

As children get older, the culture of computing as well as the computer itself continues to be implicitly male. Fisher and Margolis note that in one particular high school the computer lab served as a socially acceptable space for what can safely be termed 'computer nerds' to congregate (2002, p. 35). This den of computers, according to Janet Schofield, "provided a context in which these boys were able to build friendships and enact behaviors that supported a positive traditionally masculine image of themselves" (qtd. in Fisher & Margolis, 2002, p. 35). Schofield explains that the boys used the computer lab to escape from the "hurly burly of the cafeteria where jocks and the social set rule." In other words, this group of high school boys, apparently shunned for their nerdish tendencies, used computers as the centerpiece to create their own community of acceptable socialization. Operating within the framework of masculine computer culture, they successfully maintained their inherent masculinity through adherence to the standards of that culture and became socially accepted and supported by their likeminded peers.

Despite their apparent position as outsiders within the high school social scene, which often seems the case with computer nerds, their status was supported by their maleness and allegiance to computers. Potential female computer nerds however were not afforded the same

acceptance. When girls came in to use the computers they were ignored and stayed only until their task was complete (Fisher & Margolis, 2002, p. 35). There was no socializing between female students and the male computer nerds, thus presumably no acceptance into their particular computer-centric culture.

This short description of one particular high school can become emblematic of why few women choose careers and education based in the computer sciences. If from birth through high school, both within the home and outside it, women are not seen in connection with computers then the culture of computing and professions that follow become built on male standards. *The Big Bang Theory* works to reflect and normalize these outsider or nerdy spaces as male. When Penny accompanies the male nerds to the comic book store, the other patrons, all male, are shocked to see a woman (Lorre, Prady *et. al.* 2008-09, Season 2 Episode 20). As well, the cafeteria of the university where the nerds work is commonly used as a setting for social interaction and the surrounding patrons who presumably also work in some sort of scientific field are predominantly male (Lorre, Prady *et. al.* 2008-09, Season 2 Episode 13). This can be understood to represent some of the problems female nerds face. If there is no designated space for them to comfortably escape the non-nerdy majority and they are not fully accepted or even acknowledged within male nerd culture, there is no real, supported place for them to inhabit. This lack of a founding cultural space can help to explain why there are so few definable images of female nerds.

The absence of a female-infused computer culture and the female equivalent of a male computer nerd in social consciousness has had lasting negative effects on women and girls interested in computers. It deprives them from the same level of experience boys receive growing up in a culture that supports male use of computers and can therefore result in women having lower levels of computing confidence. Problems relating to experience and confidence can in turn work to inhibit women from choosing education and careers based in the computer sciences. One problem seems to fuel the other and thus men overall seem more comfortable on a computer, which is reflected in their education and employment choices. Fisher and Margolis write that by the time children reach middle school boys have spent countless hours, both alone and with other boys, on the computer “playing games, manipulating games” (2002, p. 40), and even attempting to alter games at the programming level. Women, on the other hand, do spend time playing games but do so with different aims (p. 41). By the time boys are over the age of fourteen, the percentage who play computer games routinely is over 50% greater than for girls. This drastic difference between the number of males and females involved in computer gaming largely informs society’s conception of what computer nerds look like. It therefore seems no coincidence that the majority of nerdy characters on *The Big Bang Theory* are male.

The lack of a definable, equivalent female computer nerd in popular culture is reflective of the reality that, in popular media and even more so as a societal standard, they are represented in far fewer numbers. As well as normalizing cultural conceptions of men and boys hunched over their keyboards shooting aliens, the greater number of gaming males obviously helps account for why fewer females have the same level of experience with a computer. As middle and high school experiences progress, boys continue to enter computer science classrooms with more experience than girls (Fisher & Margolis, 2002, p. 40). As Fisher and Margolis write “[g]irls in high school, then, are often sitting shoulder to shoulder in classes with boys who have spent endless hours learning everything they can about computers and who have friends to turn to when they want to learn even more” (p. 40). This description of a typical high school brings up not only the problem of girls having potentially less experience and therefore less familiarity and skill than boys but of how there exists no real network of computing girls. The gendering of computers as a male-use object and the exclusion of women from computer culture makes

females in computer science classrooms the exception rather than the norm. This lack of support and representation, both sitting next to you and within the consciousness of acceptable popular culture, can make computer science an isolating experience, fuelling the cycle of female reticence.

Education and the Gendering of Computers

The problem of fewer females in the computer sciences as well as the masculinization of computer culture within dominant culture is made worse by many school curriculums. Fed by the erroneous yet socially accepted belief that males are naturally better than females at computing, much of what is taught in classrooms is built around the needs and wants of the male student. As studies have shown that gender dynamics in school greatly discourage females from signing up for computer classes, what is taught and how it is taught seems a large portion of the problem (Allen & Thomas, 2006). Despite inherent ability and talent, many able and willing girls choose not to take higher level computing classes due to founding gender biases. So ingrained are these socialized truths that talent is thought only to rest on the male side of gender, making women 'less-than' by default. Thus, school classrooms both reflect and propagate the attitudes of dominant computer culture.

In one study conducted on classrooms in Victoria, Australia, researchers found that the content of the curriculum heavily favored teaching technical skills as opposed to more social activities that are in fact necessary for future careers in the computer sciences (Allen & Thomas, 2006). These technical skills would presumably be more accessible and relevant to male students who have spent a greater portion of their leisure time exploring computers. At higher levels of education, research has shown that incorporating more of a socio-technical approach to information technologies increases female participation by as much as 70%. Women and girls are therefore not necessarily turned off by the content of computer sciences, but perhaps more by the way it is taught and by what they experience in the classroom. Education is therefore a key site for change. Schools at all levels play a huge role in constructing computer culture as male and reproducing subsequent gender expectations. Attempting to make computer classes appealing not just for male students would help women garner the base knowledge needed for high-level careers in the computer sciences.

Along with syllabi tailored to male dominated computer culture, potential female nerds can be discouraged from entering computer classrooms because of outright discrimination. Women in some higher level computer classes reported having to endure unsettling comments about their bodies, appearance, and skills (Fisher & Margolis, 2002, p. 35). This seems largely a male response to females stepping outside their socialized boundaries and can be understood as backlash against women assumed not to belong. By moving against the norms of femininity, they open themselves up to undue and prejudicial treatment. When one woman complained a teacher always used references to football, a sport epitomizing masculine behavior, the teacher responded that she could do her work on anything she chose. This was followed by a suggestion from a male student to do her project on sewing (p. 36). Obviously a jibe referencing a stereotypical female activity, this comment seems to have been a reaction to her presence and to her questioning the privileged masculine standpoint. It seems also to demonstrate how ingrained and normative the male computer nerd has become in the computer sciences and how, similar to men playing sports, men's working with computers has become a naturalized, gendered activity.

There are many factors that limit equal female participation and success within the computer sciences. Experience, educational background, and discrimination as well as the overall socialization of computers as a male space work against potential female nerds and can

combine to negatively affect their confidence. According to Fisher and Margolis (2002), girls who lack confidence in their given abilities will be less likely to pursue something unfamiliar to them (p. 38). In the context of computer culture that so clearly favors males and the male standpoint, this can be understood as a huge deterrent. The one-sided computer culture as well as the social understanding of the male computer nerd work to shape beliefs about who belongs where and make it all the more difficult and undesirable for women to pursue the computer sciences. What women need therefore is some kind of change to make the culture of computing more inclusive.

Recognizing Female Computer Nerds

If one of the central problems of computer science is the nonexistence of a female computer nerd trope and a culture of computing that by default negates anything perceived feminine, the solution might be to redefine, or really begin to define, how a female computer nerd operates. There are understandably potential problems in creating something necessarily oppositional to current male standards. Anything opposing current norms can run the risk of being relegated to the status of 'less than.' Because it would allow for greater representation, a female nerd trope to openly counter the male nerd trope could result in an illegitimate standpoint and one that is assumed hierarchically lesser by virtue of current conceptions of gender. As well, creating a culture of computing that incorporates more female values necessitates recognition and acceptance that female ideals will in part be different than masculine ideals. This positioning of male versus female values can very easily become an essentialist enterprise. It is therefore crucial to remember that redefining computer culture means a valuation of traits actually beneficial to the field of computer science and not only good for women because they happen to oppose the status quo. For the purposes of comparison it might be helpful to define the differences between the two. However, there must be an implicit understanding that there are not necessarily any intrinsic male and female belief systems, only values that we have been socialized to accept as belonging to one gender or the other.

As it stands, even without the proposed mixing of so- called male and female computer values, there are women who work in the computer sciences. Therefore, female nerds do exist. However, the positions the majority of these women hold within the field are indicative of the dominance of male computer culture. A study conducted at Simon Fraser University looking at the participation and portrayal of women in the computer sciences seems representative of the overall female presence and where women choose to focus their studies. In 2000, only 20% of students in information technology classes were women compared to the 70% majority that women held in classes focusing primarily on the social aspects of technology (Allen & Thomas, 2006). At the time of the study, students at Simon Fraser University had trouble recalling and identifying women in the computer sciences. Almost 60% of the students did not know any women working in that field. Further, 56% could not recall any female role models, even in the media. Characters in movies and television often act as representatives of social norms, and therefore the students' inability to recall female computer nerds in the terrain of popular culture reflects the smaller numbers of women in the computer sciences.

However, despite the inability of the male computer nerd trope to actively define what it means to be a female computer nerd, female nerds are unquestionably a real phenomenon. Their identification takes an interesting opposition to current conceptions of male nerds. What they like about computers seems far less centered on what one person can do with one machine and more about how computers can be used to the benefit of other fields (Fisher & Margolis, 2002, p. 50). Female computer nerds therefore appear far less individualistic and want to use their talents for more social purposes. As such, they seem far less identifiable than the male nerds

who spend day and night in front of the computer screen and initiate little social contact. Female nerds are a group that does not necessarily wear their passion and thus can appear less geeky and less socially awkward. What separates female nerds from other females who choose to use a computer are their skills and passion for computing, albeit often manifesting differently than male computer nerds.

Speaking in generalities, female computer nerds value the ways in which computers can be used to better facilitate communication (Miller, 2001). In classroom studies, young girls reported that the ease of being able to email and instant message and added greatly to their enjoyment of the time spent on computers. Female nerds also view their love and talent in computer sciences as a means to an end. They compute with a purpose and believe that a degree in computer sciences can open them up to employment in many different fields (Fisher & Margolis, 2002, p. 51). Instead of focusing on the machine itself like so many male computer nerds, women describe their "multiple interests and their desire to link computer science to social concerns and caring for people" (p. 54). Pursuing computer sciences with a social perspective sets them apart from male computer nerds who tend to focus on the mechanical and technical aspects of computers. Women's reasons for entering the field of computer science become counter-narratives to the descriptions men give and thus can be understood as the makings of a female computer culture that opposes currently held beliefs. Female computer nerds therefore look quite different from their male counterparts both in ideology and how they choose to spend their time in front of a screen. Female nerds also bring a different kind of knowledge to the computer sciences.

Treading slightly into essentialism, research into feminine ways of knowing has begun attempts to revalue empathy and caring as feminine traits overshadowed by an androcentric standpoint (Lagesen, 2007, p. 72). Given the marginalization of women in the computer sciences, identifying how characteristics gendered as female can be legitimized within the current, overtly masculinized computer culture can make the entire field more appealing to women and help ensure that the special knowledge they posses by way of their socialized position receives the recognition it deserves. Taking into account the principles of standpoint theory it can also be argued that women bring different cultural resources gleaned from different experiences to the field of computer sciences. This added diversity could go a long way in opening up new opportunities for the use of computers. Given that women generally view their interest in computers in relation to their other interests, female nerdism is marginalized and unrepresented within a culture of computing that clearly favors and only recognizes masculine characteristics. As demonstrated throughout many episodes of *The Big Bang Theory*, the male nerd and the home he finds within dominant computer culture makes little room for alternatives, regardless of potential and interest. Female nerds are less an aberration and more simply made invisible. Installing a female theoretical standpoint to offset the male within the culture of computing seems a necessary and beneficial objective.

Legitimizing Female Computer Nerds

Understanding that there is such a thing as a female nerd and that her rare existence in popular culture reflects the dominance of male computer culture calls for increased representation. There have been several strategies to break the cultural connection between males and computers suggested through research conducted on women interested and working in the computer sciences. Most seem to revolve around changing the culture of computing in some manner, demonstrating just how powerful the masculinization of technology has been in the socialization of women in the sciences. Allen and Thomas (2006), citing the problem of women dropping out of information technology classes in secondary school, suggest that this concern

must be addressed in primary school and thus long before they reach university and have already made their choice (p. 176). Lagesen (2007) also suggests using education to negate the current, highly masculine computer culture. That women enter the computer sciences in fewer numbers than men can be understood "as having to do with discriminatory practices and flaws in the education system and student culture" (2007, p. 70). Again, the system of education, both reflecting and sustaining the myth of technology as innately masculine, is cited as having contributed greatly to many women's decisions to steer clear of the computer sciences. Lagesen suggests that employing knowledgeable faculty well aware of the biases in computer culture as well as providing better facilities and support will encourage more female participants. Establishing a more equal computer culture early on in a student's education and continuing with that same belief system through high school and university will help dissipate assumptions of male superiority. Creating a more inclusive culture in the classroom could help female students feel more comfortable exploring their computer related skills and interests.

As part of the changes that should take place in the classroom, the culture of computing present in both education and employment settings should also support the more social aspects of computing. More women could be encouraged to enter the computer sciences should the interpersonal and communication based side of information technology be highlighted. The trope of the computer nerd and "the idea of the computer professional working long hours in isolation is clearly not true, but this stereotype is still prevalent" (Allen & Thomas, 2006, p.168). Jobs within the computer industry including business analysts, software engineers and network engineers require excellent interpersonal skills and should be showcased as such. Embodying computer nerdiness is often not enough to guarantee career success and advertising the more social side of computer sciences could go a long way in encouraging women who might have otherwise overlooked the entire field. Speaking more theoretically, legitimizing female knowledge within the realm of computer science might help women who had felt otherwise opposed to the values of current computer culture find a comfortable space within it. Recognizing characteristics understood as feminine, including empathy and subjectivity, as equally valuable could help some women feel more at home in a technological space (Lagesen, 2007, p. 72). In other words, changing the solely masculine focus supported by the current culture of computing would create a more socially acceptable and comfortable space for women to demonstrate the skills they can bring to the computer sciences.

Finally, returning again to the notion of the almost exclusively male computer nerd perpetuated by popular culture mediums like *The Big Bang Theory*, creating a definitive female nerd within social consciousness could help normalize a female presence in the computer sciences. This female computer nerd would not, of course, merely be a male nerd with pigtails, but embody different, sometimes opposing values. Given that students in the Allen and Thomas study identified the media as one of the greatest influences on their perceptions of careers in information technology and, for example, women are found in far fewer computer advertisements, there seems a cultural disconnect between women and the computer screen. Suggestions to help reach women at a younger age have been to create all-female computer clubs in schools and to run a technology column or page directed specifically to women in computer magazines, thus changing the culture of computing from the bottom up (Allen & Thomas, 2006). As Allen and Thomas explain, "[p]rint media and TV could be a powerful influence in changing the perceptions of potential IT students" (p. 177).

Creating female characters with substance and computer skills, less reflective of male nerd ideologies and more of something different and new, could help the proliferation of female nerds in popular culture. There are women who are incredibly skilled and genuinely enjoy working with computers. The problem is not that female nerds are not there, but that they

aren't being represented. Televisions shows like *The Big Bang Theory* that both initiate comedy around nerdy characters and idealize their intelligence must also create positions for women that do not follow in male nerd traditions. Female nerds are something different and, in order for the culture of computing to become more inclusive and for women themselves to feel more comfortable entering the computer sciences, there needs to be an increase of pop culture representation to help pave the way for change.

The notion of nerdiness is not unfamiliar. Popular culture abounds with representations of lanky male bodies with glasses, odd haircuts, and permanent seats in front of a computer. Male nerds are acknowledged outsiders in a world where beauty trumps smarts, however still understood as necessary by way of their superior intelligence and technical expertise. As proven by the popularity of *The Big Bang Theory*, nerds can be interesting and comedic foils to the dominant understanding of masculinity that favors big muscles over big brains and heterosexual prowess over skills in front of a screen. The culture of computing, regardless of its relative marginality, is nonetheless a male space sprung from male values. There are few positive representations of female nerds in popular culture that do more than ape the male standards. As such, the real female nerd with separate desires and wants is lost to the social assumption that the world of computer technology is solely a male space.

The lack of cultural framework to positively support the notion of the female nerd as well as the masculinization of computer culture has arguably contributed to the disproportionate number of women entering and finding success in the information technology sector. Forced to take a position of deviance, women in the computer sciences must either slip into the ill-fitting values of the male nerd or work against the overwhelming tide of masculine values and thus risk seeming irrelevant. This is assuming, of course, that they choose to take the plunge in the first place. While there are likely many reasons fewer women than men choose to enter the computer sciences, the domination of the male nerd within popular culture as exemplified by *The Big Bang Theory* and the masculinization of computer culture surely plays a significant role.

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