

# Gender in Computer Science

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## INTRODUCTION

Computer science (CS) is defined in *wikipedia* as a branch of human knowledge “relating to computation, ranging from abstract analysis of algorithms and formal grammars, to subjects like programming languages, software, and computer hardware” (Computer Science, 2005). Computer science emerged as a distinct field in the 1940s and 1950s with the development of the first electronic digital computers. To limit computer science to just computer use or its knowledge bodies, however, is reductive; CS is embedded in a complex, unquantifiable cultural context, including socio-economic and gendering practice. Computer hardware and software are designed to complement and supplement human activity and processes such as warfare, industrial applications, information management, including education, the Internet, a knowledge commons, and most recently biotechnology. Although CS is typically considered neutral and scientific, its episteme and practice is androcentric or male centered, often to the exclusion of females (Herbst, 2002). Female attributes have not typically been associated with computer science or computers. Although there is general agreement that women are as intellectually capable as men in CS, the fact remains that women today do not have equal participation in CS majors, CS engineering, programming, software design, Web site construction, or computer repair. (Jepson & Perl, 2002). In the technetronic 21<sup>st</sup> century, when computers are becoming standard for education and in symbolic analytic jobs, women’s enrollment in CS has declined, and many women do not feel confident using computers for more than e-mail transmissions, e-commerce, and social interaction in forums or newsgroups. Women who do not have knowledge or confidence in their abilities to work in CS not only have unrealized potentials in CS but also are left out of employment activities. Reasons for gendering in CS are complex and debated. Socialization, overt and tacit discrimination, and epistemological plural-

ity are three dominant explanations. CS industries, educators, cognitive scientists, parents, and women professionals in CS are some of the groups currently working to attain gender equity in CS.

## BACKGROUND

CS is typically viewed as abstract, formal, logical, and objective with strong connections to mathematics. Viewed from a gender perspective, however, CS is androcentric in origin, product creation, and product dissemination. (Herbst, 2002; Littleton & Hoyles, 2002) CS scientific and technical research did not simply follow from a eureka; CS technology research and development in the past and present reflect the priorities of American male political and economic elites and their international allies. Computation and CS are creations of the military, the communications industry, and academic science. Computer graphics imaging (CGI) for example, originated during WWII with radar technology, and lexical constructions from this military *paterfamilias* still exist, such as *execute*, *terminate*, and *abort*. Cutting edge CS research continues today in the military, private industry, and academic institutions. Prominent among them: Naval Research Laboratories; XEROX’s Palo Alto Research Center; Sun Microsystems; Microsoft; Stanford University; and Carnegie-Mellon University. Although CS applications still reflect the priorities of private industry and the military, the Internet, originally a military-scientific database, is now available to the public. As a communication and knowledge commons, the Internet is a major tool for participation in CS and electronic culture in the 21<sup>st</sup> century.

Just as the knowledge base of CS is predominately androcentric, so, too, is the culture and practice of CS, which is revealed in a number of ways: male dominance in CS professions; CS product manufacturing for public consumption, exemplified by the computer gaming market; CS journals, such

as those published by the Institute of Electrical and Electronics Engineers (IEEE); CS print media geared toward CS career people with *Wired* magazine as one notable example; mass media images of CS products and practitioners, such as advertising; and male dominance on the Internet (Jackson, Ervin, Gardener, & Schmitt, 2001).

Popular print journalism and mass media are especially revelatory in terms of CS culture, real and imaged. *Wired* magazine, with its tech-speak and high-tech graphics, is interesting in terms of what it reveals about the qualities of androcentric CS culture. Geared towards an educated, affluent male readership, although 20% of *Wired* readers are female, the magazine has a predominance of hacker jargon, sexually appealing cyborgs and avatars (Wolf, 2003), and an aggressive tech-speak style that is the patois of the male CS culture. Beliefs and mythology of CS and “cyber religion” are also evident. Male computing, for instance, is expressed as a macho territory with the hacker as rebel. What is also evident in *Wired* is that CS and its language builds connections among men (Margolis & Fisher, 2001), which, in turn, provides men with the CS social and cultural capital that is useful for building and maintaining professional careers. Stereotypical CS images in other forms of mass media also extend the pervasiveness of androcentric CS culture. Analysis and deconstruction of mass media images in advertising, video games, and film reveals gendering of techno-culture. Advertising, for example, promotes stereotypes and also proselytizes the manly heroics of CS activities and careers. Frontier metaphors are often applied to CS activity: freedom, self-determination, profiteering, and egoistic individualism. These stereotypes and images eventually become part of the tacit knowledge of society and people’s conceptions about CS culture.

Androcentric CS culture is also evident on the Internet, a knowledge, and communication commons and a circuit for e-commerce transactions. Although use of the Internet by females has increased dramatically in the last few years, females still use the Internet less and in different ways than males. The Internet is predominantly a male terrain reflecting male values and interests, such as the proliferation of sexually explicit material (Barron & Kimmel, 2000). Although a recent report by the

European Union claims women have overtaken men in Internet usage, with women ages 55 and older increasingly gaining computer skills (European Union Commission Staff, 2005), the report, *eInclusion Revisited: the Local Dimension of the Information Society*, indicates female computer use is social in nature, mainly comprising e-mail to family and friends. Women may surpass men in e-mail use on the Internet, but males pervade in all other areas: Web site design and administration; information retrieval; recreational, academic, and professional discussion boards and forums; blogging; and wikis.

The professional and occupational practice of CS is also androcentric, although socio-economics, education, and family socialization can qualify an individual woman’s participation in CS (Rajagopal & Nis, 2003). Although occupational employment predictions for the early 21<sup>st</sup> century indicate a high need for people with CS degrees (Hecker, 2001). Only 27.7% of bachelor’s degrees awarded in CS in the U.S. are earned by women (Freeman, 2004), and women terminate their degrees earlier than men, earning fewer advanced degrees in CS. When women do find employment in the technological field, generally they are in gendered positions such as data-entry clerks or “keyboard operators” while men hold the higher paying and higher status positions such as analyst, programmer, and engineer. Even when women do work as analysts and engineers in CS industries, they admit to feeling less comfortable in the terrain than their male peers, even though they have the same proficiency (Moskal, 2002).

In general, women have lower level of participation in digital culture, although there is agreement they are as capable as men intellectually. What is the explanation for this?

Gendering in CS is a complex issue with many differing arguments and no consensus (Clegg, 2001; Gunn, McSparren, Maclead, & French, 2003; Jackson et. al, 2001). Three dominant explanations are socialization, discrimination, overt and tacit, and epistemological pluralism.

## GENDERING IN CS: SOCIALIZATION

In Western middle class educational settings and home life, CS enculturation is evident at an early

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