

Women and Computing

Breaking the Cycle of Imbalance at the Interface

D.RAMANEE PEIRIS, PETER GREGOR and INDIGO V

Department of Applied Computing, University of Dundee, Dundee DD1 4HN, UK
rpeiris@computing.dundee.ac.uk

Abstract: In the world of computing, women are in the minority. Computer software and systems in common use have been developed by male-dominated teams. As designers design systems that they like, a male perspective comes through the software and leads to the belief that computing is a male subject. Girls therefore do not find computing interesting nor is it a field they want to work in. Few of the girls who enter computing become designers. The reasons behind this cycle include gender differences in the way information is processed, and the self-perpetuating public belief that computing is inherently male. The cycle can be broken at any stage, and many attempts have been made to encourage girls into computing classes and courses, and join the IT industry. We propose that the cycle should be broken at the interface design stage - all designers should consider the female perspective when designing. This will start to change the opinion that computers are only for men, will lead to more females in the discipline, and we suggest that this will produce better computer systems for everyone. This research was funded by the Carnegie Trust for the Universities of Scotland

1. INTRODUCTION

There is a gender imbalance in favour of males in computing. Far more boys than girls study computing beyond school. Fewer women than men are computing professionals. This leads to the public perception of computers and computing as a man's world. Various projects and schemes have attempted to change females' attitudes. A reassessment of the discipline is proposed by Grundy [14] as a solution to this imbalance.

In this paper we review the imbalance, and present one such reassessment. We define the cycle of imbalance of the genders in computing,

a cycle in which each aspect compounds the next. We look at the differences between men and women, the way these are manifested in computing, and the way in which designers of computer interfaces have tried to address gender differences. We suggest that a change to the way in which computer interfaces are designed could break this cycle of imbalance, leading to more women in computing, and better computer systems for all.

2. THE CYCLE OF IMBALANCE

The world of computing is perceived as inherently male, for many self-perpetuating reasons, shown diagrammatically in Figure 1.

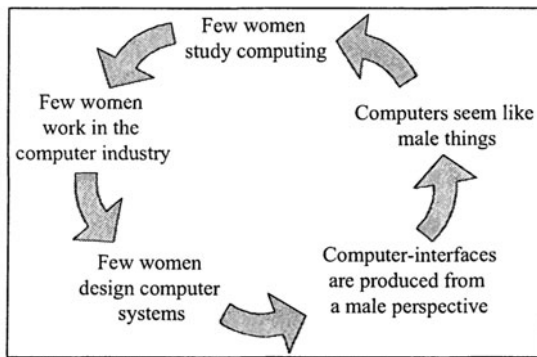


Figure 1 The cycle of imbalance

Female computing graduates are in the minority, and some choose other career paths than the computing industry. This leads to low numbers of women in computing jobs, hence a small proportion of software and computer system designers are female. However much designers try to take a user-centred approach, they usually develop computer interfaces which they themselves like, and find easy to use.

We suggest that, if most designers are male, then most systems and their interfaces are designed from a male perspective. This leads to software which requires the user to 'play' in order to determine functionality, and systems with difficult to understand commands, icons and menu names. This enforces the view that computers are male things. Few girls wish to study such a subject, and so the cycle continues.

3. GENDER DIFFERENCES

Before examining gender differences that contribute to the lack of women in computing, and the lack of a female perspective in computer

interfaces, it is useful to consider gender differences in general. While most people would agree that gender differences exist, the debate about how these arise continues - from our biology or from differences in our experiences, expectations, and the attitudes towards the different genders?

Two types of cognitive ability where a gender difference can be shown, are verbal and visual-spatial [20]. The within-sex variation in these abilities is large, such that there are many similarities in ability between individuals of both sexes [15].

Females have better verbal abilities than males. This is apparent at an early age when girls develop better quality language than boys. Males score higher than females in spatial perception, mental rotation and spatial visualisation tasks, whereas on spatio-temporal (moving display) tasks, a clear gender difference does not emerge [11, 15, 26]

Studies have shown that there are cognitive styles that predict differences in cognitive functioning. Females are more field-dependent than males, that is, women are more influenced by their surrounding context than men. Males more field-independent than females, they can handle one task independent of the others going on around them [28].

Sex stereotyping begins at a very early age. Toddlers start to show sexual stereotypes as early as two years old [27]. Boys and girls tend to play with different toys - boys are given more vehicles, toy animals, and military toys, while girls are given more dolls, doll's houses and domestic objects [25].

In employment, positions of power and respect are more often held by men. Sex stereotyping is strong, aided and abetted by the media stereotypes of women.

4. GENDER DIFFERENCES IN COMPUTING

We now examine how the cognitive differences identified above influence our use of computers. We consider gender differences during childhood, and education as well as in the workplace, and through the use of the Internet.

4.1 Developing computer skills in childhood

Stereotypes specific to computer use exist from a young age. Early use of computers for game playing is likely to leave boys more experienced, confident and motivated in computing [10]. Playing fewer computer games at an early age could be a factor in girls being less positively disposed towards computers and the resulting lack of interest in computer courses [18]. Home computers are often bought specifically for the male child, and

even when purchased for the whole family, boys use it more and girls have less access [14, 5]. In a 1982 study of high school pupils, 60% of boys and 5% of girls used a computer at home or participated in computer-related school activities or clubs [19]. By 1994, despite the dramatic increase in computer use, there was no significant change in these ratios [13].

At school, attitudes toward gender and computing mean that there is less access to computers for girls and educational software is directed at boys. Boys tend to monopolise the limited computer resources. Girls tend to be attracted to courses that do not include the use of computers, and those who do take computing courses frequently find themselves surrounded by males in class [14]. Careers advisers, by their own admission, tend not to promote technical careers to girls and there is little encouragement for girls to study computing at a higher level [17].

4.2 Computing in higher education

In higher education, there are low percentages of women taking and graduating from computer courses. Girls and women tend to avoid technological courses and go for subjects with more social involvement. Many of the women who do study computing feel they are treated as less capable or less interested in technology than men, and they are often put off by a male environment. However, women achieve equally good grades as men on Computer Science courses [14].

The percentage of bachelor's degrees awarded in the US to women in computing has decreased almost every year in the last decade [4]. In 1996-7, only 14% of Scottish undergraduate computing students were female [8].

4.3 The computing industry

The number of women in the computing industry is not consistent with other levels in society [21]. This is due, in part, to the low number of computing graduates and the fact that "women are not applying to our company [IBM] for employment as programmers". Companies are keen to attract women partly because of the skills shortage and partly because women are perceived to have better communication and other skills which they see as highly desirable, such as team-working, negotiating, the ability to handle several projects at a time and interpersonal skills" [12, 22].

In academic computing departments, the numbers are also low. In a 1997 of computer science professors, only 19% of assistants, 10% of associates, and 6% of full professors at US universities were women [1].

4.4 Gender and the Internet

Of all the areas of computing, the Internet has been singled out by many as the most 'female-friendly' simply because it is a communication tool. Women seem to understand better what the Internet can do for them. Women are changing the way the Internet works by being more task-orientated, taking control and networking [3].

It is estimated that 40% of online users in the UK and 50% of US users are female. Women are using the Internet to contact friends, and buy CDs, whereas men are more likely to be playing games, downloading software or reading newsgroup messages [24].

As with face-to-face communication, women are helpful and co-operative, while men tend to be co-operative only when there are prescribed rules of behaviour [29]. Women and men have different characteristic online styles that are recognisably gendered. Men use putdowns, strong assertions, lengthy postings, self-promotion and sarcasm. Women offer support, characterised by expressions of appreciation and other community-building activities that make other participants feel accepted and welcome. On lists where men have posted as women and vice versa, others have challenged this based on the characteristics above [16].

4.5 Computer Games and Gender

There has been little work in the area of gender and the computer interface. The attempts made by the computer games industry to address gender differences in computer interface design are discussed here.

Boys' greater involvement with computer games leads to their increased confidence with computers and, their larger representation in computer jobs. Computer games tend to perpetuate the competitive image of computing, with themes of war, crime, destruction, and male-orientated sports. So, girls who feel alienated by the violent nature of many games may end up disadvantaged in the field of computing in later years. However, games with less violence and aggressive soundtracks have been identified as being preferred by women. This includes the puzzle-based games Pacman and Tetris. Tetris in particular is popular with professional women because it is about coping and bringing order to chaos. Other games preferred by women have a fully visible board, characters with personality that girls can relate to and softer colour patterns [7, 5].

It is frequently noted that most computer games are designed by men for men – therefore, the games industry could double its market if it produced computer games that females wanted to play. Creating that software is a challenge for the games industry, to some extent created by the cycle of

imbalance. The games industry needs “more women in the industry, as designers, as programmers, as artists. We need to break the barrier”[2]. When designers were asked to design software specifically for boys and girls, they produced learning tools for girls and game-like challenges for boys. When asked to design software for a mixed group, they produced game-like challenges showing that they thought of boys when supposedly designing for all [17].

4.6 Breaking the cycle of imbalance

Good software needs to be designed in conjunction with its users. HCI focuses on the needs, tasks and goals of computer users in order to create computer systems and software so that users can carry out their tasks *effectively, efficiently and enjoyably* [23]. Unfortunately many systems are badly designed, inappropriate for the task at hand, and difficult to learn. This is frequently because the designers were focused on costs, limitations, and quirks of technology, trying to automate tasks to the detriment of these users [6]. Designers sometimes consider the user's age, cultural background or special needs, but rarely their gender.

Computer interface design has been male dominated, with terms such as ‘execute,’ ‘abort’ and ‘kill’ used for interacting with the computer. Most current graphical user interfaces (GUI) have evolved from the command line languages which used these terms to WIMPs (Windows, Icons, Menus and Pointers) - frequently still command-based, if directly manipulated. They were designed by computer experts, mainly men, and are only intuitive for those who are familiar with their concepts.

If a different, female perspective was taken to human-computer interface design, computer software and computer systems should become intuitive, easier to use, and more popular. This should allow for interfaces for all - everyone can have the interface which best suits them.

The gender differences discussed earlier showed that women have better verbal abilities than men. This may mean they prefer interfaces where the content has a more 'natural' dialogue. The greater field-dependency in women may lead them to prefer a 'question and answer' style and possibly menu selections. When using computers, men are likely to prefer more pictorial interface to accommodate their suggested advantage in visual-spatial skills. This could be in the form of direct manipulation systems, especially ones that use icons and pointers [11]. An initial step must be to find examples of interfaces that do work, software or devices with easy to grasp mental models, or those that use real-world metaphors.

Web sites can 'remember' the path we took, and may offer suggestions depending on previous usage. Some software packages use a limited version

of this, such as 'recently used' file lists. Others allow customisation, but it is hidden away in the menu structure and the user needs to know how to use it before options can be set. One potential development could be software applications and underlying operating systems that have adaptability at their core. This would include a choice of interaction styles from free text entry (which could be speech driven in the future), to menus and direct manipulation. These would all be available to the user initially, but usage would be monitored to allow gradual, automatic, adaptation. Similarly, filing systems could be changed to a model that is easier to navigate than a hierarchical structure that requires the user to remember which path to follow to find a file.

5. SUMMARY

We have suggested that designers need to take a fresh look at the interface, looking at the user - especially their gender, their cognitive abilities, and the differences in the way they organise their work. This may start to change the perception of computing as a male discipline. If the subject is no longer seen as male, then the proportion of girls wanting to study it should increase. In turn, and in time, this will lead to balance in the profession and amongst designers. This new generation should continue to ensure that gender and individual differences are major considerations in interface design. The cycle is then broken, computing is no longer seen as male, and computer systems are designed from a difference viewpoint.

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