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The FLOSS ideal of equality, inclusivity and freeness is sadly let down by the gender imbalance of its participants, with women comprising just over 1 percent of FLOSS developers. Yuwei Lin analyses the causes of the gender digital divide and suggests a way to help close it

Introduction

Software is at the heart of the development of information communication technologies (ICTs). In an ICT based society, it is increasingly important that software is designed to meet the requirements of diverse users. To do so, several software processes have been proposed to update the traditional ones. Methods such as Participatory Design (PD), agile computing, User-Centred Design (UCD), and eXtreme Programming (XP).¹ These methodologies, though different, have a common goal of making software products more friendly and more diverse for various types of end users. The development mode of Free/Libre Open Source Software (FLOSS) is one of the most common and successful examples of this aim.

FLOSS has become a prominent phenomenon in ICT field and the wider public domain in the past years. Its success has also attracted researchers from different disciplines to analyse its unconventional innovation approach. But according to a FLOSS survey on FLOSS developers in 2002, 'women do not play a role in [FLOSS] development; only 1.1% of the FLOSS sample is female.'² In the mainstream research on the FLOSS community, many researchers also overlook the diversity of the members, and presume a stereotyped male dominated 'hacker community'. Moreover, the issue of gender inequality is often ignored and/or muted, in the pile of FLOSS studies. Not only are female programmers often rejected ex/implicitly from the software labour market, but also the needs of female users are not respected and consulted.³ This feature is opposite to the ideal world of FLOSS where all users are treated equally and embraced. Compared with the abundant literature on the processes of FLOSS development, the gender problem is marginalised. While many researchers endeavour to understand the process and structure of FLOSS related organisations and management, few find a gender biased situation problematic. In short, women are almost invisible in current FLOSS related literature and most policies advocating FLOSS development are gender blind.

Thus, this essay highlights the need for increased action to address imbalances between women's and men's access to and participation in FLOSS development in cultural (e.g. chauvinistic and/or gender biased language in discussions on mailing lists or in documentation), economic (e.g. unequal salary levels for women and men), political (e.g. male dominated advocacy environments) and technical (e.g. gender imbalance amongst students in technical tutorials) spheres. But on the other hand, it also emphasises the powerful potential of FLOSS as a vehicle for advancing gender equality in software expertise. FLOSS helps transfer software engineering knowledge and experience through the distribution of source code and binary code almost without limit. Many free software licences such as the General Public Licence (GPL) also facilitate the flow of information and knowledge. In other words, if appropriately harnessed, FLOSS stands to meaningfully contribute to and reinforce the advancement of effective, more expedient solutions to bridging the gender digital divide. This article also points out that while women in advanced countries have a better chance of upgrading their ICT skills and knowledge through participating in FLOSS development, the opportunity is less available for women in the developing world. It is worth noting that though the gender issues raised in this essay are widespread, they should not be considered as universal. Regional specificities affecting gender roles within the software industry should be taken into account.⁴

Gender problems in the software industry

To a degree, the gender problems in FLOSS development can be seen as an extension of the ongoing gender issues in new tech service and software industries.⁵ These long term problems mainly include low level work content, unequal pay, emotional distress from discrimination and prejudice, physical ache from the long working hour in front of the computer, division of labour within the home (child rearing), essentialist notions of women's roles, sexism, informal networks, prejudice, lack of role models and support, and 'glass ceilings'. Generally speaking, women within the software industry have to work harder than men in order to get the same respect and conquer the glass ceiling problem in this patriarchal world.⁶

Many studies have undermined the stereotyped presumption of a biological sex difference between men and women causing women to be less interested in scientific and technological fields.⁷ Instead, there is significant evidence that that school curriculum and methods of teaching technology in school should be adjusted to bridge the gender gap⁸ through educational means, such as encouraging women to pursue higher education or jobs in scientific and technological areas, and governmental policies to support and promote women in ICT.

The software industry has perceived these problems and tried to solve them. For instance, HP, Sun, Xerox and Compaq have sponsored the Institute for Women and Technology (IWT)⁹ and other universities in a US wide program to bridge the gender gap in technology and support the development of technology products focused on women's interests and needs. Most of the software companies now also provide a series of women friendly policies, including extended maternity and paternity leave, accommodation for emergency leave, and superior benefits, in order to cover childcare and family accommodation. Unfortunately, according to observers, motherhood is still seen as a liability for women's advancement, and the pay of women continues to suffer after having children.¹⁰ The software industry is socially constructed - men's superiority over women and an essentialist gender division of work are continuously reiterated.¹¹

Towards a feminist analysis of gender issues in FLOSS development

Although FLOSS has dramatically changed the way software is produced, distributed, supported, and used, and has a visible social impact enabling richer digital inclusivity, most of the gender problems existing in the software industry have been duplicated in the FLOSS field.

The methodological concepts 'social world' and 'system' can help in understanding FLOSS development.¹² A FLOSS social world is different from what Sherry Turkle described when she stated that 'computer systems [mainly proprietary] represent a closed, controllable microworld - which appeals to more men than women'.¹³ It requires a holistic perspective to capture the complexity and dynamics within and across the (FLOSS) social world. While its heterogeneity and contingency has not yet been fully explored, analysis from a feminist perspective is almost absent. Little attention has been paid to internal differences and to the private domain which connects to the system of FLOSS innovation. However, this methodological lack has not stopped us from observing the gender problems within the field. Instead, in the context of FLOSS development, some gender problems in ICT become even more apparent.

For example, most FLOSS graphic interfaces appear less advanced. The mainly text based nature of FLOSS is so predominant that women, who usually have few coding experiences, are less familiar with its operation. Instead of stemming from some biological sex difference, the phenomenon suggests a lingering deficiency of women's IT education and women-unfriendly products and tools.

Additionally, in a world of volunteers, we clearly see that, as in all media, both men, and a competitive world view are dominant in FLOSS. Many women participating in FLOSS development are invisible; their labour in fields such as NGOs that help implement and promote FLOSS documentation, translation, book editing, teaching and tutoring (e.g. E-Riders) is less visible than it is in the male dominated field of coding work.¹⁴

linuxwomen

Collage > Raquel Perez de Eulate

Indeed, in light of Okin's argument, I would like to suggest that FLOSS advocates have not adequately addressed this critique of gender equality.¹⁵ They tend to treat the FLOSS community as a monolithic culture and pay more attention to differences between groups than to differences within them. They are so eager to unite the voices around the fight for freedom of information that they give little or no recognition to the fact that FLOSS groups, 'like the societies in which they exist (though to a greater or lesser extent), are themselves *gendered*, with substantial differences of power and advantage between men and women.'¹⁶ Apart from that, FLOSS advocates often do not take the private sphere into account when proposing an alternative agenda for a knowledge based society, which is often articulated as the 'public domain'. This relativisation of the private sphere is unwise in that it 'neglect[s] both the different roles that groups require of their members and the context in which persons' senses of themselves and their capacities are first formed and in which culture is first transmitted - the realm of domestic or family life.'¹⁷ In other words, if a more liberal and democratised information society were to be established, as the FLOSS movement intends, domestic arrangements need to be taken into consideration. 'Home is, after all, where much of culture is practiced, preserved, and transmitted to the young.'¹⁸

A number of key dilemmas that hinder women's participation in FLOSS development can be summarised thus:

1) Strong long-hour coding culture

In terms of women's relation to and experience of FLOSS, it is observed that women are found mostly taking trainee positions that follow regular nine-to-five working hours, rather than a less stable coding job. This often is due to the fact that women need to take care of the housework and require steadier working hours. A successful FLOSS project requires volunteers to commit to it progressively but women usually have less spare time and energy to donate than men. This way of working makes it very difficult for women to succeed in the business. It must be incredibly hard for women with children to navigate the hours. If men could share the child-rearing more equally, it would allow women more time to take on the consuming role of programming or leading a FLOSS project.

2) A lack of 'mentors' and role models

It is true that there is a very low percentage of female participants in the FLOSS social world. However, we should not overlook the importance and possible future of outstanding female figures in the FLOSS field such as Allison Randal and Amaya to name two who are already making a difference.¹⁹ It is difficult to make the majority of male peers respect these female figures. For instance, I have observed that when Randal spoke at the Italian Code Jam 2004, she acted, and also was treated, as more of an assistant to Larry Wall rather than an outstanding programmer who should be granted the respect of her male peers. I am not suggesting that men all look down on women, but it is more difficult for women to be assertive in front of a predominantly male audience.²⁰ The whole way the world is constructed means there are simply men at every level, which makes it really hard for women to get their foot in the door. A way of overcoming this is to establish more female luminaries in the IT world. While few actually know that Ms. Ada Byron was the first programmer in the world,

how can we expect people to recognise women's ability?

3) Discriminating languages on/offline

There is still a strong 'chauvinistic mentality', extended from the society we live in to the FLOSS social world. As the barrier to accessing FLOSS references is relatively low compared with other proprietary software projects, there should be fewer problems for participants regardless of gender, class, ethnicity and religion. However, many female FLOSS developers have complained of the extremely unfriendly atmosphere within the social world, online (e.g. mailing lists, IRCs) and/or offline (e.g. documentation). For instance, in reference to prospective readers, existing FLOSS documentation usually uses the pronoun 'he' rather than 'she' or 'they'. This kind of gender-biased word use subtly excludes women from participating in the FLOSS development. While the online languages are in a direct way full of men's jargon, reading the documentation offline does not make a female developer/user feel more included in the field.

4) A gendered text based environment

A text based coding environment somehow reinforces the gendering of ICT. In saying so, I am not suggesting that women are less equipped for coding in a text based environment; instead, I would like to argue that such a coding environment symbolises its remoteness and the difficulty of establishing subjectivity within a male dominated coding culture.

The difference between text based and graphic environments hinges on the issue of ability to recall the keystrokes and commands. Coding in a text based environment is useful for those who use tools so regularly that they can easily recall the commands. Graphic environments help present commands in visual forms for users who would otherwise have to look them up. It is often said that coding environments are just a matter of taste and separate from gender or other social factors. However, if this is only a matter of preference, why is there such a prevalent impression, if not stereotype, that being able to code in a text based environment shows greater computer literacy? Doesn't it instead reflect the state of programming jobs, where most of the frequent programmers are male?

Additionally, it is observed that women usually obtain their programming expertise through the formal education system. Unfortunately, formal educational institutions rarely have text-based coding included in their curriculums. Instead, it is more common to learn windows-oriented graphic coding environments such as Microsoft visual basic, visual C++ or Java. While coding for proprietary software is continuously reinforced, it is difficult for female programmers to be involved in FLOSS development that requires the skill of coding in a text based environment.

5) A lack of women-centred views in FLOSS development

The lack of female FLOSS developers results in a greater amount of female unfriendly software in the FLOSS system. Some scholars in science and technology studies (STS) have pointed out that technologies are gendered both in their design and use.²¹ The social relations of gender within the FLOSS social world are reflected in and shaped by the design of FLOSS. The lack of women's perspectives on software design and use restricts women's participation in FLOSS development and, in turn, produces the stereotype that women are almost absent in FLOSS development because they are less able to program. This absence of female developers is a disadvantage for FLOSS development, and results in inequalities in an ICT-based society.

6) A male dominated competitive world view

[The OSS market] is literally a war for the best and brightest. If we don't get there, somebody else will.

Andrew Clark, Director of strategy and market intelligence for the venture capital group at IBM²²

As Arun and Arun point out, 'The project-based, competitive nature of software development reproduces a masculine culture, which further interacts with the different career patterns of women and social norms and tends to disadvantage women.'²³ While statements in a similar tone to Clark's repeatedly surface in the mass media, the masculine competitive world view is continuously represented and reinforced in society. This carries over to the FLOSS social world, where more powerful, male members are generally in a position to determine and articulate the group's beliefs, practices, and interests. It is very alarming that on the whole the perspectives and purposes of FLOSS development are determined by white men.

How can/does FLOSS empower women?

There are three main objectives for the current 'women's movement' in the FLOSS community: 1) the provision of women friendly software and services; 2) the creation of a women friendly environment for developing and using FLOSS and; 3) the fostering of a gender balanced ICT innovation system for both competition and collaboration. These three points have close connections with one another - in order to create technology based products that engage and build on women's ideas and visions, we need to create a more women friendly environment in order to attract more women to participate in FLOSS development. Encompassing such a women centred view of design, which usually resembles a more sympathetic and inclusive way of doing things, will possibly foster a gender balanced ICT innovation system that is not only friendly to women but also to various minority groups. This system, unlike the current highly competitive approach, will draw on aptitudes and competences of diverse actors in the FLOSS social world so as to develop a holistic environment which is based on a collaborative approach.

Networking is important in 'democratising the access and dissemination of knowledge. In order to encourage women's participation and also to explain the operation of FLOSS to women, some female developers/users have started to network and form online groups such as, LinuxChix, KDE Women Gnurias, GenderChangers, and Debian-women.²⁴ They act to dispel the unfriendly wording in documents and, in online peer groups, to report sexist bug reports to other developers and give online tutorials. Networking and gathering, online or offline, can serve as a basis for gender inclusion.²⁵

Research the future!

It is anticipated that through conceptualising and documenting the current gender issues in FLOSS development, it will help enlarge the knowledge base for gender sensitive policies on ICTs, and propose a women centred policy towards developing and implementing FLOSS. While FLOSS represents a new milestone for software development and knowledge production in a broad sense that might alter the social relations of gender,²⁶ 'in this technoscientifically advanced era, feminist politics make wider differences in the women-machine relationship than the technologies themselves'.²⁷ As such, a gender-sensitive agenda for developing FLOSS is urgently needed.

However, in speaking of implementing and developing FLOSS, most of the cases are centered on or situated in developed countries. One should bear in mind that there are many undocumented activities that have happened in the developing world. When strengthening the advantages of FLOSS, we should not overlook many problems emerging from implementing FLOSS in developing countries, such as a lack of sufficient training and support.²⁸ The digital divide must be considered as a symptom of inequality, not the cause of it. There is a need to understand what local people really need: water, food, jobs, decent healthcare and sanitation, or software and ICT infrastructures. ICT gender issue might be more complex than we have seen here. Female participants very often suffer from hybrid discriminations, both from the male-dominated FLOSS world and socio-cultural patriarchy, although virtual groups such Linuxchix Brazil and Linuxchix Africa have started providing women with help in

solving problems in implementing Linux, more effort needs to be made in documenting, analysing and deconstructing the patriarchal hegemony embedded in the whole ICT infrastructure.²⁹ As such, like many other fields concerned with gendering, this essay is a mere beginning - an analytic stage on which 'we need to place the details contributed by ethnographic research, cultural critiques, sociological surveys, legal scholarship on men and women in their many specific conditions and subjectivities.'³⁰

This is an edited version of the paper submitted for the encyclopedia Gender and IT <http://genderencyclopedia.ist.psu.edu> to be published by IDEA Groups in 2006. This draft is released under the General Public Licence. The document itself has the potential to be improved in an open source culture. If you have comments or ideas on how it can be improved, please do not hesitate to contact me. Later the online version will then be adjusted to take account of these points

FOOTNOTES

¹ See, Schuler, D. & Namioka, A. (eds.), *Participatory Design, Principles and Practices*. Hillsdale, NJ: Lawrence Erlbaum Associates, 1993; McBreen, P., 'Software Development: Dismantling the Waterfall', Boston, MA: Addison-Wesley, 2002 <http://www.informit.com/articles/article.asp?p=25272>; Norman, D. & Draper, S. (eds.), *User Centered System Design: New Perspectives on Human-Computer Interaction*, Hillsdale, NJ: Lawrence Erlbaum Associates, 1986 ; and <http://www.extremeprogramming.org/> or <http://www.xprogramming.com/>; and, Beck, K., *Extreme Programming Explained: Embrace Change*, Boston, MA: Addison-Wesley, 1999

² See, Ghosh, R.A. et al., 'Free/Libre and Open Source Software: survey and study. Deliverable D18: Final Report. Part IV: Survey of Developers' International Institute of Infonomics, University of Maastricht and Berlecon Research GmbH. The original version of this document is available at <http://www.infonomics.nl/FLOSS/report/>

³ See, Levesque M. & Wilson, G., 'Women in software: Open source, cold shoulder', *Software Development*, 2004 <http://www.sdmagazine.com/documents/s=9411/sdm0411b/sdm0411b.html?temp=TgtgS9YUY8>; and, Public report on the consultation meeting on European perspectives for open source software", <ftp://ftp.cordis.lu/pub/ist/docs/ka4/tesss-OSS-report.pdf> 2001

⁴ See, UNDP Bratislava Regional Center and UNIFEM Central and Eastern Europe, *Bridging the Gender Digital Divide: A Report on Gender and Information Communication Technologies (ICT) in Central and Eastern Europe and the Commonwealth of Independent States (CIS)*, UNDP/UNIFEM, 2004

⁵ See, Mitter S. & Rowbotham, S. (eds.), *Women Encounter Technology: Changing Patterns of Employment in the Third World*, London: Routledge and The United Nations University, 1995

⁶ See, DeBare, Ilana, *Women in Computing: Logged On or Left Out? A Sacramento Bee Special Report*, Jan. 21, 1996

⁷ See, Bleier, R., 'Sex difference research: Science or Belief?' In R. Bleier (Ed.), *Feminist Approaches to Science*. New York: Teachers College Press, 1991, pp. 147-164

⁸ UK Equal Opportunities Commission, *Plugging Britain's Skills Gap: Challenging Gender Segregation in Training and Work*, Report of phase one of the EOC's investigation into gender segregation and modern apprenticeships. Equal Opportunities Commission, UK, 2004

⁹ <http://www.iwt.org/systers.html>

¹⁰ See, Walby, S. & Olsen, W., *The Impact of Women's Position in the Labour Market on Pay and Implications for Productivity*, Department of Trade and Industry Women and Equality Unit (WEU) funded research using the British Household Panel Survey, 2002

¹¹ See, Walby, S., 'Segregation in employment in social and economic theory' in S. Walby (ed.) *Gender Segregation at Work*. Milton Keynes: Open University Press, 1988, pp. 14-28; Rubery, J. & Smith, M. & Fagan, C., *Women's Employment in Europe*, ch. 5 'Occupational Segregation', London: Routledge, 1999, pp. 168-222; and Miller, L. et al, *Occupational Segregation, Gender Gaps and Skill Gaps*, Manchester: Equal Opportunities Commission, 2004 www.eoc.org.uk

¹² See, Lin, Y. *Hacking Practices and Software Development: A Social Worlds Analysis of ICT Innovation and the Role of Open Source Software*, 2004, Department of Sociology, University of York, UK. (Unpublished doctoral thesis)

¹³ Turkle, S. *The Second Self: Computers and the Human Spirit*. New York: Simon and Schuster, 1984

¹⁴ <http://www.eriders.org>

¹⁵ See, Okin, Susan Moller, 1999, <http://www.bostonreview.net/BR22.5/okin.html>

¹⁶ Ibid

¹⁷ Ibid

¹⁸ Ibid

¹⁹ Allison Randal is the president of the Perl Foundation and part of the core developers in the Perl 6 project. Amaya is a Debian GNU/Linux developer and one of the founders of Debian-Women group

²⁰ Fieldwork at Italian Code Jam 2004, Ferrara, Italy: <http://www.codejam.org/index.en.html>

²¹ See, for example: Edwards, P, 'Gender and the Cultural Construction of Computing', adapted from 'From "Impact" to Social Process: Case Studies of Computers in Politics, Society, and Culture, Chapter IV-A,' *Handbook of Science and Technology Studies*, Beverly Hills: Sage Press; and, Wajcman, Judy, *TechnoFeminism*, Polity, 2004

²² From an interview with C|Net.com, February 14, 2005

²³ Arun, S. & Arun, T. G, 'Gender at Work Within the Software Industry: An Indian Perspective', *Journal of Women and Minorities in science and engineering* 7(3), (2001)

²⁴ <http://www.linuxchix.org/>, <http://women.kde.org/>, <http://www.gnurias.org.br/>, <http://www.genderchangers.org/>, <http://women.aliioth.debian.org/>

²⁵ See, Nordli, H., 'The Gathering Experience: A User study of a Computer Party' presented at the 'Strategies on Inclusion: Gender and the Information Society (SIGIS)' conference, 2004, http://www.rcss.ed.ac.uk/sigis/public/displaydoc/full/D05_2.12_NTNU1

²⁶ Lin, Y. op. cit

²⁷ See, Wajcman, op. cit.

²⁸ Guardian, February 17, 2005. 'Bridging the digital divide',
<http://www.guardian.co.uk/online/story/0,3605,1415713,00.html>

²⁹ <http://www.linuxchix.org.br>, <http://www.africalinuxchix.org>

³⁰ See, Sassen, S., *Blind Spots: Towards a Feminist Analytics of Today's Global Economy*, 1999,
<http://www.uwm.edu/Dept/IGS/presentation/sassen.pdf>

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