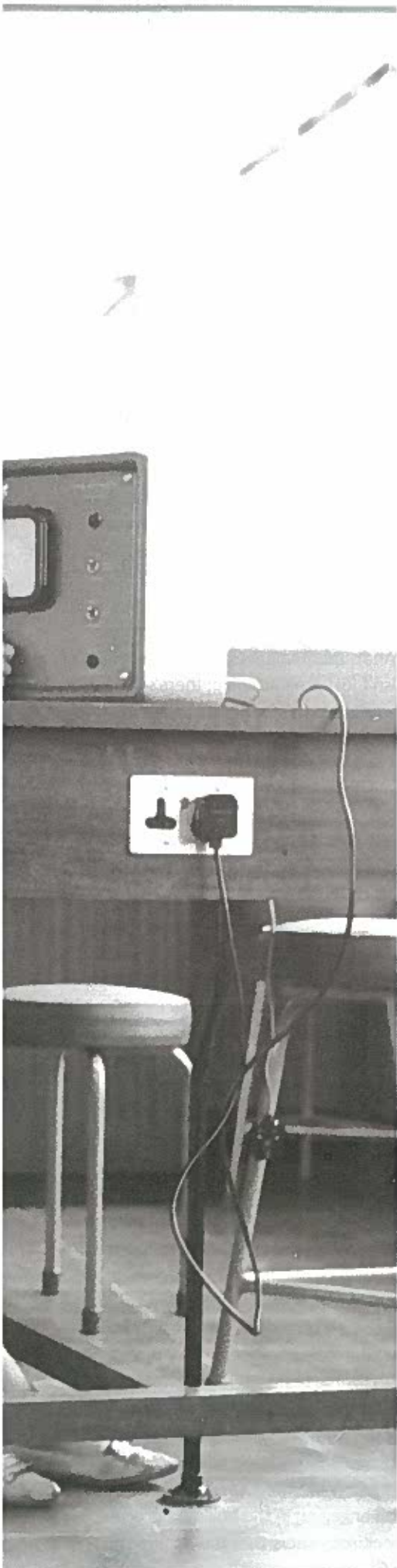


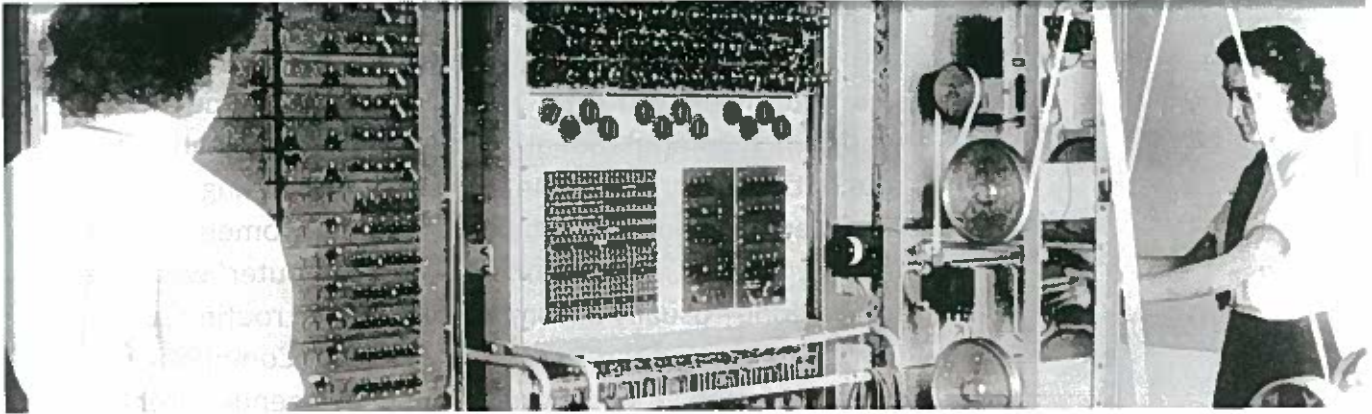
The early years of computing were full of women. It's estimated that over 80% of the staff at Bletchley Park during the war were women, operating some of the world's first computational machines, and contributing to the foundations of British computing. Early computing courses attracted fairly equal numbers of men and women students. Indeed, the first meaning of the word 'computer' was to refer to someone - usually a woman - performing routine sums. Sometime around the 1970s, this changed. Computing became a discipline and indeed a profession with a gender problem. Now, women number about 15% of the technical workforce, and there is a clear 'leaky pipeline' with women choosing to drop out at each stage of educational progression.

WOMEN IN COMPUTING:

*the problem, why we should be
bothered, and what we should be
doing about it*

Words by Hannah Dee





Why this is happening is hard to determine: it happens in most western countries, but less so in other parts of the world. Maybe women just aren't interested in computers. Or maybe there's something that's putting women off – for example, maybe there's something about school computing that makes women think computing is not for them. Or maybe there's a broader image problem.

When you ask children to draw a picture of a computer scientist, they usually draw a guy, wearing glasses, probably with spots, hunched over a keyboard. If you do an image search for 'computer scientist', the first page is full of pictures of stereotypical nerds - the ones for 'programmer' are just the same. Whatever we want to say about the discipline and the profession, one thing is clear, and that's that computing has an image problem.

WHAT'S HAPPENING IN SCHOOLS?

There's been a crisis in school computing which came to a head last year with the Royal Society calling for a major reform of the technical curriculum in their publication *Shut down or restart?*. The problem was that the nation's schoolkids simply don't know what computer science is – in schools, students study information and communications technology (ICT), which involves spreadsheets, word processing, and maybe some databases or web design. Computer science – systems, programming, networks, algorithms – doesn't get a mention. In universities we see this at interview every year, and in computing departments across the UK there are freshers wondering what they've let themselves in for. This isn't a problem that's unique to computing (most law students, for example, haven't studied law before they get to university), but coupled with our image problem it has major implications, particularly in terms of gender.

In 2012, the number of women choosing to do computing at A-level fell to 297 (that's 297 women across the whole of the UK - there were just 38 women A-level computing students in Wales). Computing in the broadest sense has been falling across the board though, not just with women: ICT A-level numbers dropped 34% between 2003 and 2012, and computing A-level dropped 60% in the same period. At university the gender imbalance from A-level continues. In Computer Science at Aberystwyth, we're pretty much average in terms of student gender ratio - hovering between 10 and 15 percent.

So we've got a problem: computing in schools is not actually

computing, and the general image problem of the subject as a solo pursuit dominated by guys means that students looking for other careers – creative, social careers - don't think of applying.

COMPUTING CAN BE FUN

I realise that some of my students might disagree, but I firmly believe that computing can be an incredibly rewarding subject. When you're programming, you're quite literally building things out of ideas, and the sense of achievement you can get from getting a tricky piece of code to work is great. When I'm programming, those "Aha!" moments are actually quite common. But computing isn't just programming: there's system design, algorithms, user experience design (making interfaces), software testing, user testing, technical training, technical writing, networking, user support and helpdesk roles, and lots of other careers. And that's before you consider management and analyst roles, further up the business tree. Only a handful of these potential careers have the opportunity to sit in a cubicle on your own writing code: the vast majority are team-based careers, requiring teamwork, creativity and (dare I say it) social skills.

SKILLS GAPS, JOB MARKETS, AND THE POWER OF DIVERSE TEAMS

One of the turning points of the last decade has been recognition from business that diversity is something to be valued. The global management consulting firm, McKinsey, have released a series of reports under the "Women Matter" banner, which show - from a fairly hard-nosed, business perspective - that diverse teams perform better within the business world. As an example, when you compare companies in the top quartile for executive gender diversity against companies with no women on their executive board, those with diverse boards have 41% better return on equity, and 56% better earnings before interest and tax¹. It's important to note that these teams aren't doing better because women are more talented at business; they're performing better because diverse teams behave differently. Monocultures tend to be self-reinforcing: if all your decisions are taken by one sector of the population, then the decision making and management style is going to be similar. What diverse boards provide is a range of different backgrounds and management styles, all engaging in the business process, and when this happens, McKinsey show that the resultant

business process is more effective.

There are other arguments for diversity in the workplace: in professions with heavy gender imbalances, the minority gender generally has a more difficult time. Male nurses take more sick days, female accountants are more likely to register on the anxiety and depression scales². There's a term - *sex role spillover* - for the way in which unrelated aspects of gender roles seep into a profession when that profession has a major gender imbalance. There's no need for computing system administrators to be interested in beer and trains: having unrelated but common interests doesn't make you a better sysadmin (although it may make it easier to chat with colleagues).

There's also a skills shortage in certain IT roles. Neelie Kroes, the EU commissioner for the digital agenda (and EU vice president) has recently proposed grand coalitions to address technical skills gaps. Skills gaps aren't uniform across the entire ICT/computing field, but exist in most sub-domains; for example, the UK's National Audit Office has recently said that unless recruitment to computing courses increases dramatically we face a 20 year wait for enough skilled professionals in the cyber security domain.

So diverse teams perform better, and there are lots of jobs (in some parts of the profession, at least). What are we doing to try and encourage girls to enter computing? Could we do more? What can be done to help?

GIRL GEEKS AND CODER CHICKS

Computing now pervades our lives. Most of us have computers in our pockets that are far more powerful than the computers used on the space shuttle; there's more processing power in some washing machines than was available to the computing pioneers of the sixties. Social networking has taken off to such an extent that now the gender ratio of computer users, gamers, and purchasers is pretty much equal: indeed the largest growing demographic in computer games is my own (35-55 year old women). So women are active consumers of technology, we're just not getting involved as creators.

Organisations and events targeted at women exist to try and break this pattern. These can be linked to professional societies, like BCSWomen (the British Computer Society's group for women in technology). Or they can be grassroots organisations, like Girl Geek Dinners, who put on talks and dinners around the world for women. There are also organisations aimed at particular areas within computing, like MzTek which targets women interested in computing and art, or CAS #include (Computers At School) which works to make computing in schools more inclusive. Dr Reena Pau, a member of CAS #include, says "we want to offer opportunities for as many students as possible to be able to experience computing - whilst of course realising it will not

be for everyone!" These organisations provide a space for women to meet and network, but they also provide support and mentoring opportunities.

Within Aberystwyth there's a group called Aber Comp Sci Ladies, started by Phoebe Murphy, who says she started it "to try and help the women in the department feel a bit less isolated and to help us support each other" (Phoebe's an undergraduate, now in her industrial year at Blackberry). School computing is being rejuvenated, by organisations like CAS, and a lot of the big companies are coming on board to help out (Microsoft, Google and IBM have all been sponsors of some of the initiatives I've mentioned). Right now, one of the really big issues is training enough teachers to deliver the new curriculum.

WHAT CAN BE DONE TO IMPROVE THE SITUATION?

- Encourage children in creative computing – things like the programming language Scratch (<http://scratch.mit.edu>) introduce programming concepts to children from the age of about 7.
- I've written a family programming day for Android phones, where we've had 6-year old girls making their first app (just a farmyard noises app, but everyone has to start somewhere!); it's free online at www.hannahdee.eu/appinventor - you could get hold of the materials and give it a go yourselves.
- More technical people could help out in schools - www.computingplusplus.org links programmers with schools across the UK.
- To find out more, the book *Little Miss Geek* by Belinda Parmar is a great introduction to this general area, and *Delusions of Gender* by Cordelia Fine is a more academic (but still readable) take on gender differences across the board.

In the words of the late Karen Spärck Jones "Computing's too important to be left to men".



Dr Hannah Dee is a lecturer in computer science at Aberystwyth, who does research into computer vision and teaches web programming. She's also on the national committee for BCSWomen, and runs the BCSWomen Lovelace Colloquium, the UK's main event for women undergraduates. She's a Science Champion on the GOWS (Get On With Science) project, and is involved in programming workshops for children and their parents in Wales and across the UK.

¹ www.mckinsey.com/~media/McKinsey/dotcom/client_service/Organization/PDFs/Women_matter_oct2010_english.ashx McKinsey, Women Matter at the top of corporations, 2010.

² [dx.doi.org/10.1016/S0277-9536\(01\)00044-2](http://dx.doi.org/10.1016/S0277-9536(01)00044-2) Olga Evans, Andrew Steptoe, The contribution of gender-role orientation, work factors and home stressors to psychological well-being and sickness absence in male- and female-dominated occupational groups, *Social Science & Medicine*, Volume 54, Issue 4, February 2002, Pages 481-492.