ACM-W CIS Newsletter: Celebrating, Informing, & Supporting Women in Computing
Volume 3, Issue 2, Summer 2011
http://women.acm.org

Summer Days!

Welcome to our summer 2011 edition of the ACM-W newsletter.

In the last issue, we discussed how we wanted to create a newsletter that would appeal to people at every stage in their career — but we needed your help to do this. Thankfully, many of you wanted to join the conversation and add your voice to the newsletter. This is evidenced by ten terrific articles written by members of the community that span everything from high school to undergraduates to 1st year of graduate school and to mid-career computer scientists.

We urge our community to continue to add to the conversations we have started here. Please consider submitting an article proposal for our winter issue with new ideas and perspectives — or challenge some ideas presented here.

In addition, in the next newsletter, we will have a special column — "Ask Judy" where the 2011 ACM-W's Athena Lecturer, Judy Olson, will answer questions from our community. Dr. Olson has over 40 years of experience in research and industry, thus she can answer any of those sticky questions we are not sure who to ask, but really need an answer for. *Have a question for Judy?* Ask it here!

— Suzanne Menzel and Katie Siek, Editors

In this issue...

From the ACM-W Chair

by Elaine Weyuker, ACM-W Chair

It is again a pleasure to welcome you to the latest issue of the ACM-W's newsletter. Co-editors Katie Siek and Suzanne Menzel have put together another wonderful new issue with articles from and about women in computing at all levels from high school to senior women.

In the last issue we had an article by three women who started families while in graduate school. In this issue we continue with the experiences of two women who had children as untenured assistant professors. If you have a different perspective to share, either having had children post-tenure, or in industry, or while taking a hiatus of more than just a maternity leave, or decided not to have a family, why not share your experience with others?

This issue of the newsletter includes highlights from the recent Fourth Ohio Celebration of Women in Computing, one of the earliest areas to have one of our Regional Celebrations. There have been a number of other recent ones and several on the drawing boards — let's hear about your successful event. It will surely inspire others to follow.

I recently had the most wonderful experience. I sit on the advisory board for a grant to introduce Computational Thinking into the high school curriculum. As part of the advisory board meeting, we visited a group of high school students who were part of the trial of one of the first modules. The students were from the Geneva, New York school district, and the meeting and trial were held at Hobart/William Smith College. I sat down at one of the tables which had two teams of high school students and an undergraduate mentor. While the teams were working on a problem, I asked the young woman mentor about herself. She had just finished her freshman year and planned to major in CS. She had taken a course in pre-programming her first semester and enjoyed it enough to take a programming course her second semester. She said that what had really cemented her decision to become a CS major, however, was a conference she had attended which she found very exciting. One of her professors and two other women undergrads had driven to a two-day meeting. There were other young women from many different local colleges and universities, and there were all sorts of activities and talks, and it really excited her to see more senior students talk about their research. Since Geneva is less than an hour from Rochester where several other attendees came from, they had started a Facebook group with plans to meet to maintain their community. I asked her whether the meeting had been in Schenectady and she looked at me, surprised and asked how I knew? I said that I chaired ACM-W and we sponsored those meetings. She whispered, "wow, it changed my life". As you can imagine, I could not have had a better present — a truly unsolicited testimony!

So if you are a student or faculty or industrial employee, why not work to change lots of young women's lives? Why not organize one of our Regional Celebrations in your area? We have expertise to help you get started, and seed money, and with your volunteer power, you can have have a wonderful Regional Celebration.

This issue has many other interesting articles, but we had no articles from any ACM-W student chapters. Let's hear from *your* chapter in the next issue. Tell us what you are doing. Do you have an outreach program to work with local K-12 schools or perhaps run a tutoring program? Maybe your chapter is working on starting a Regional meeting — wouldn't that be fabulous? Share your experiences and let everyone know about how cool your group is! Don't have an ACM-W student chapter at your school? Start one! Chapters can now be chartered on-line and can be started anywhere in the world.

Like every issue, there are announcements of upcoming awards and/or relevant scholarships that can be applied for, and about relevant meetings that may be particularly interesting to women at different levels of careers ranging from students to the most senior women

academics and practitioners. Let us know about your upcoming event or consider attending one listed in the announcements.

As I said in the last issue, this newsletter is *your* newsletter. In addition to reporting on regular ACM-W projects, we want readers to be our reporters. What is going on in *your* world vis a vis women in computing? This is your chance to be a roving reporter. We'd all like to learn about the status of women in computing in your part of the world, or relevant activities you've been involved in. Are you involved with an outreach program for students? Let us know about it — inspire us! That's how every ACM-W project got started: someone had a smart idea that made us say, "I wish I had thought of that."

We will soon be starting another academic year. I hope this is a wonderful year for each of us!

Publish and Prosper or Procreate and Perish?

by Katie A. Siek and Minaxi Gupta
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Introduction

Being a tenure track professor in academia is like running your own startup company. The funding agencies are like venture capitalists (VCs) and the students are like employees. You have to choose the most fruitful ventures in terms of research directions, get them funded through federal agencies or private funding, find the best employees, work as hard as you can, and hope for the best. While the flexibility of what hours you work and from where is great, the job of a professor is demanding as it is satisfying. On the one hand, it offers unique perks that a CEO of a startup can only dream to have, such as the guarantee of a significant portion of our salaries, outstanding health insurances when a record 20% of U.S. citizens struggle for it, protection from a pink slip (which only gets better with tenure), and the ability to impact the next generation of innovators. On the other hand — the job can be incredibly demanding, nerve wrecking, and often looks like a never-ending list of "to dos". It is more so for female faculty who wish to raise children, particularly those with spouses who have equally demanding careers. In this article, two female computer science professors at two different universities, working in two diverse areas of computer science and married to spouses who are also professors in computing areas, recount their experiences in trying to balance career and motherhood.

When to Have Children


A Siek Family Ski Trip

One of the first questions many career-minded women grapple with is the best time to have children. Both of us had our children while being assistant professors as opposed to having children during graduate school or post-tenure. Each stage of academic life poses unique challenges, so it is tough to say which stage is better to have children. On the one hand, life as a graduate student is demanding and one is often financially constrained, but being young is an undeniable asset to child bearing. On the other hand, tenure brings job security, but fighting the ticking biological clock may make matters uncertain. In some sense, both of us adopted a middle ground by deciding to have children as assistant professors. Our reasoning was that having a decent income, a roomier living space, and a good health insurance plan was worth sacrificing a few years of youth. However, not waiting until tenure in the interest of keeping our chances of having children reasonably high did pose unique challenges since we went against the conventional wisdom of not taking on more than one has to while being an assistant professor.

Among the first challenges we faced was the challenge of balancing pregnancy and then motherhood while adjusting to life *on the other side of the table*, that too in a new city. We emphasize "the other side of the table" because few of us realize as graduate students that sitting on the other side of the table upon graduation is not as straightforward as it looks. While graduate students are trained primarily to do research and write papers, sitting on the other side involves knowing a lot more than what we were trained to do. For starters, very few of us get an opportunity to design and teach our own courses as graduate students when this is among the first challenges we faced as assistant professors. Similarly, most graduate students do not participate in writing grant proposals when it is often a large component of an academician's job.

Fortunately, we were helped by a supporting atmosphere and the presence of other colleagues who were pursuing parenthood in a similar stage of life. We also are hopeful for future improvements in how parenthood and the tenure-clock are handled based on our colleagues comments about having similar experiences. In addition, research in the area of dual career couples (Stanford's Dual Career Academics Program, http://www.stanford.edu/group/gender/ResearchPrograms/DualCareer/) and parenthood during tenure (Armenti 2004, Loeffler, Ely, & Flaherty 2010, O'Laughlin & Bischoff 2005) helped educate us about the impact of parenthood on tenure and how it can be mitigated.

Out of sight, Out of mind

Among the biggest challenges we faced as new mothers can perhaps be best summarized as "out of sight, out of mind". It is essentially the fear of losing Ph.D. students while on maternity leave. Most universities offer maternity and paternity family and medical leaves (FMLA) that are competitive with industry. For example, Indiana University offers a 12-week leave with full pay, along with teaching and service relief. However, a maternity leave in academia is nothing like its counterpart in industry, in our experience. In particular, while a woman could possibly truly take time off in industry since her job will likely be covered by someone else, such is not the case at a university. Often, her courses will have to be rescheduled to be taught at a later time since replacements are hard to find due to most departments having only a few faculty in each area of specialization. Depending on the course, this teaching delay may impact her ability to introduce students to her research area and train students in methods needed to conduct research in her area. Worse is that during the time she is on the leave, the students she advises will not be able to meet with her as often to make research progress. This will not only hurt the overall research productivity of her group, but may also cause her students to drift away from her and toward other faculty, causing all the effort she spent in training those students to be wasted from her perspective. In turn, her publication record will suffer, further effecting other factors, such as funding, in the longer term. We felt that the key to avoiding all these issues was to not avail ourselves of the entire maternity break. We recognized that an unfortunate consequence of making this choice could be delayed postpartum recovery and that it may even hurt the bonding process with our babies. However, we both finally chose to return to work part time within a couple of weeks of delivering our babies in the interest of our careers. This choice was less than ideal for our children and our families but allowed us to meet with our students on a regular basis and keep our publication pipelines healthy. Coupling the part-time return with video conferences over Skype or iChat with students and collaborators was instrumental in helping us keep our research careers intact.

Stopping the Tenure Clock

Universities offer a unique perk that facilitates motherhood. Almost all allow for the possibility of extending the tenure clock by one or two years if one is on leave for medical reasons, such as maternity, sickness, or to take care of a sick loved one. The rationale behind this extension is that each faculty member is entitled to a full five years of time, by default, to prepare a compelling tenure case and if one or more leaves cuts this duration short, they are entitled to additional time. This additional time is in year(s) instead of months because the tenure decision process follows a specific timeline, typically starting at the beginning of the fall semester after a faculty member finishes five years and ending at the end of the spring semester of that academic year.

As specific instances, Indiana University offers a one year extension on the tenure clock if the total leave period (across, say, multiple pregnancies) is less than nine months. The University of Colorado allows faculty to stop their tenure-clock twice for one-year extensions (say, for multiple pregnancies). Here, we both took slightly different routes. While one of us chose not to avail the option of stopping the tenure clock due to help from family members, the other had to avail the option of extending the tenure clock by one year. The ability to stop her tenure clock helped her balance her new responsibilities as a mother and advisor — a time blurred by sleepless nights and inadequate research time. Irrespective of the route one takes in this regard, it is an important consideration for striking a balance between motherhood and career.

The F Word

We jokingly refer to funding as the “F word” in this article. Jokes aside, funding can be an issue for maternity leaves and tenure clocks. For example, some grants have a hard start date where everyone must start at the same time so the cohort of funded researchers can collaborate together. If the principal investigator, the faculty member who leads the grant, happens to be on maternity leave at that time, then she has to decide between forgoing the funding or continuing with the funding and cutting her maternity leave short. Unfortunately, assistant professors have effectively no choice, given the well-known pressures of obtaining funding and the role it plays in making or breaking tenure cases. Further, when grants do fund research, there is a contract on what will be done and in a specific time frame. Therefore, it does not matter who is having children — the principal investigator or a research assistant — the research must get done on schedule and disseminated to the community. Some funding agencies provide no-cost extensions, where the grant can be extended an extra year without additional funding, however it is not always possible to take this type of extension after childbirth. From an advisor’s perspective, the principal investigator must provide her students with an environment to progress in their studies and research. If a no-cost extension were to be considered for the advisor to have a child, the students may not have funding during the year the grant was held up, and thus it would halt students’ progress. If a no-cost extension were to be considered for a research assistant to have a child, it would effect the pre-tenure advisor’s ability to conduct research and disseminate results in time for their promotion time frame. Thus, it is difficult to have children in either position — advisor or research assistant — when it comes to funded research.

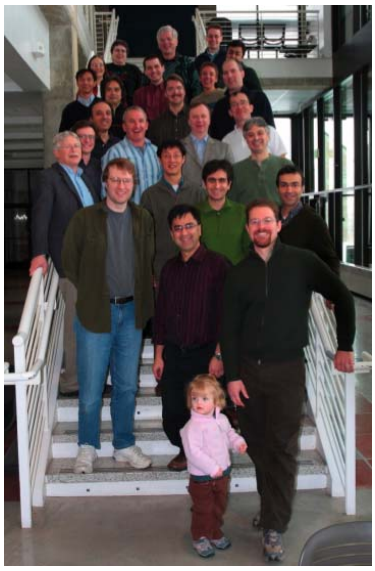
We were both lucky in that we only had to deal with the conflicts of funding and initial motherhood from our end, as none of our students were in the same boat during our initial years as assistant professors. We chose to address the issue by closely integrating motherhood with our professional lives. For example, when our babies were young, it was not uncommon to have our nanny in a nearby office with a baby swing and activity mat while we met with students and collaborators in our lab spaces. This arrangement allowed us to provide the attention needed to each group and keep things running smoothly. We were also lucky to have self-motivated and understanding graduate students who were willing to have Skype meetings at wee hours. Looking back, however, we wonder if funding agencies could be convinced into accommodating maternity leaves and challenges of motherhood. Granted, it would be hard, given their mission to push science and innovation forward. However, we believe the issue needs to be raised and investigated.

Baby's Got a CV....and a Frequent Flier Number

Having a baby impacts travel as well. Traveling to conferences, program committees, funding agencies, and to give talks at other universities and companies is an integral component of academic life. It nurtures existing collaborations and opens up avenues to new collaborations. Unfortunately, travel conflicts with motherhood for a long time to come, often much longer than the postpartum recovery. For one thing, we can no longer spend a little extra time on sightseeing before an international conference. As new mothers, we were often conflicted between our professional development and the emotional and physical developmental responsibilities toward our children. As a first step, we both, just like other mothers pursuing academic careers, cut down on travel. We also tried to travel with spouses, other family members, nannies, or use childcare services at hotels and even airports. Further, we tried to trim the duration of our trips in an attempt to gain the most out of travel while keeping the time away from our children to a minimum. There were many occasions when we made day trips for conferences and various meetings, with the worst being a day trip to Berkeley, California from Bloomington, Indiana with a connecting flight in each direction adding to the travel time! It is hard to estimate whether lesser travel hurt our careers in any way or if we were able to offset the ill-effects of less travel on our careers with these strategies, but one thing is sure — it has not been easy.

> *I have frequently been questioned, especially by women, of how I could reconcile family life with a scientific career. Well, it has not been easy.*
>
> Marie Curie (1867-1934), Winner of 2 Nobel Prizes, Mother of a Nobel Prize Winner

On a related note, we sometimes found it difficult to separate parenthood and professional life. There were occasions when we had to bring our children to professional meetings without childcare help. Often, these meetings were held on weekends or after business hours. By the age of two, one of our children had attended six conferences, three Grace Hopper Celebrations (a special thank you to conference sponsor supported childcare), two in-person program committee meetings, and multiple professional meetings. In a sense, our children have been acquiring CVs from before they could even read or write!



Daddy juggling Program Committee duties with 2-year-old in tow

Our colleagues have been incredibly supportive of bringing children to meetings, which we continue to be indebted for. In fact, they were generous enough to note the child's name in attendee lists and in meeting pictures. The picture above shows an example of a case where our spouses had to pitch in and bring our children to meetings. Our graduate students have also done their part in understanding our situations, happily accepting to discuss research while our children were playing alongside.

For Better or for Worse

Although we present a woman's perspective on motherhood in this article, parenthood has had a similar impact on our spouses' careers because it has caused them to alter their work and travel schedules as much as ours, especially once our children were less dependent on us. Not only did our partners have to be more mindful of their travel schedules, we often had to negotiate trips and work schedules to make sure that one of us was responsible for taking care of the baby at all times, with some help, of course. A middle ground that worked for us was that we had an agreement with our partners that we would not commit to doing any more than two business trips a month for the two of us combined so our families could spend more time together. We also negotiated technology-free hours at home so that we could fully engage with our children when with them. While it works on an everyday basis since day-to-day emails can wait, we had to agree on exceptions to this rule around paper and grant deadlines.

"Don't Leave Before You Leave"

While most of this article may come across as if we got everything right in pursuing motherhood as assistant professors, we did made a few mistakes that could benefit our readers. One of these mistakes was the decision to teach a course during the semester the baby was delivered. This apparently masochistic decision was made to avoid teaching that course as a third course during the first year of the baby's life. However, in retrospect that trade-off was not worth it due to the stress it imposed on the postpartum recovery. Though the particular course in question was a special topics course with a relatively small group of highly motivated graduate students, balancing the first several weeks of motherhood with the demands of course was difficult.

Another mistake can be best summarized as "don't leave before you leave" — advice from Facebook's COO, Sheryl Sandberg (Sellers 2009). It pertains to the decision to postpone submitting papers to conferences or declining a program committee invitation, or some other research, teaching, or service opportunity, in an attempt to plan around delivery, recovery, and the resulting constraints on travel. This decision led to small gaps in the publication record, something which could have been easily avoided had we arranged for the student authors on our papers to travel instead. Alternatively, the papers could have been extended into journal articles.

At some level, both of these mistakes occurred when our attempts to plan for future eventualities backfired, and we feel that they could have been avoided. While we dare not advocate against future planning, taking some time off for postpartum recovery may pay off by actually bringing a mother back into commission sooner.

The Silver Lining

Motherhood is fulfilling as it is challenging. We were lucky to have had the opportunity to experience it while enjoying flexible work schedules, excellent healthcare, and good financial resources. While it has not been an easy journey, it has brought unparalleled joy to our lives and made us better, more conscientiousness, human beings.

There is an additional silver lining to going through motherhood as a tenure-track assistant professor. It has made us more *efficient*, *driven*, and *focused*. We both find that when we are at work, we are more directed and more "no-nonsense" than we were prior to having children. One might even say that we are less social than before since there is no time for long or leisurely lunches, chatting in the hallway, at the printer, or in the break room. We also actively resist having meetings without a predetermined goal or agenda. Each time we get a meeting request, we go through a series of questions in our head, "Do I really have to be at this meeting?" and "How does this meeting help with reaching my goals or the goals of some collective body I belong to?". We chose to avoid any engagements for which we fail to find concrete answers to these questions. When we are at work, we strive to make the most of every moment there since we know that we must use those hours to really focus on our

students, research, teaching, and service, each of which are important components of success as a professor. An overall positive side effect of time constraints brought by motherhood is that we have learned to say “no” to things we cannot do justice to or things we deem to not be furthering our professional careers or personal lives.

At the Louisville Science Center

For better or for worse, many in our generation have moved far away from the way families were setup in our parents’ generation, where men were the primary breadwinners and women were responsible for housekeeping and children. A side effect of this choice is that both we and our spouses have to be deeply connected to the well-being and upbringing of our children. Among other things, this journey has helped us better express and formulate our research ideas and become better educators. It has helped us see the subtlety in Einstein’s quote, “If you cannot explain it simply, you don’t understand it well enough”, as we dealt with our toddlers’ never-ending questions about the world around us. Katie also recalls an incident when she was thinking about the question, “Why don’t parents follow the approved guidelines for early childhood nutrition?”, in her research. The answer became clear when she experienced her own child refusing every vegetable serving — then she understood why her study participants could not get their children to eat what researchers had identified as healthy.

We also find that we have become more *balanced* individuals. Before children, the pressures of tenure pushed us to work during all our free time. Typically, we would work the standard eight hours, go out to eat, and then work until the wee hours of the morning — seven days a week. In addition, we often made the mistake of not taking any vacation time. All of this changed after we had our children. It started by working staggered hours. In both of our cases, we shifted our working hours where one spouse would start earlier than the other and do an early pickup from childcare and the other would start late to do a drop-off at the childcare. This minimized keeping our children away from us longer than seven hours. Now, after the daycare pickup, we cook dinner together, play together as a family, and often work after our children go to sleep. During the weekends, we often only work a half day so that we can enjoy quality family time. In addition, we have started taking advantage of vacation time to ensure we have some contiguous days of family time. Another big change brought by motherhood was reconnecting with our parents in ways we had not in years prior. Our parents now visit us to be able spend time with grandchildren, which not only enriches the lives of our children, but also our own lives, since it has allowed us to re-kindle our bonds with our parents. Overall, we both feel that motherhood has created more balance in our lives. It has made us feel more refreshed and ready to take our work head-on when we work.

Finally, motherhood has brought a sea change in our attitude to others in that we have became more *understanding*. We now think of every person we interact with as someone’s child and may be someone’s parent. We often ask ourselves, “How would I like my child to be treated as a student, scholar, colleague?” “How would I like to be treated as a parent when my child is sick?” Questions as simple as these have helped us see the world and the people around us differently and we are grateful for the personal developments.

Acknowledgments

We thank Dola Saha for her thoughtful comments on this article.

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Archival Plans and Pedagogical Materials for Computing Educators Oral History Project

by Barbara Boucher Owens and Vicki Almstrum
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The Computing Educators Oral History Project (CEOHP) continues to evolve. Since the first interview was collected in 2005, the project has undergone several phases. The most recent changes have resulted from a careful process of evaluation that has led to many changes on the website to better highlight key features of the collection.

An exciting development this past year was an agreement to partner with the Charles Babbage Institute (CBI) for long-term archival of the interview materials. They will index and store the audio, video, and transcripts for all of the finalized interviews, so visitors to the CBI site will be able to discover CEOHP interviews via CBI's finding aids.

A promising addition to the CEOHP website is a special section dedicated to educators suggesting ways to use the CEOHP collection in instruction. This section includes instructional materials provided by two educators as a starting point. We expect this section will grow over time as others begin to explore pedagogical uses for the collection. We are in the process of indexing the CEOHP materials on the Computer Science Teachers Association (CSTA) repository to make it easier for pre-college educators to find these materials and integrate them into their own lesson plans.

For more information, please visit the website (ceohp.org) or contact the authors.

Two Generations of MIT Women Engineers
by Chris Miyachi

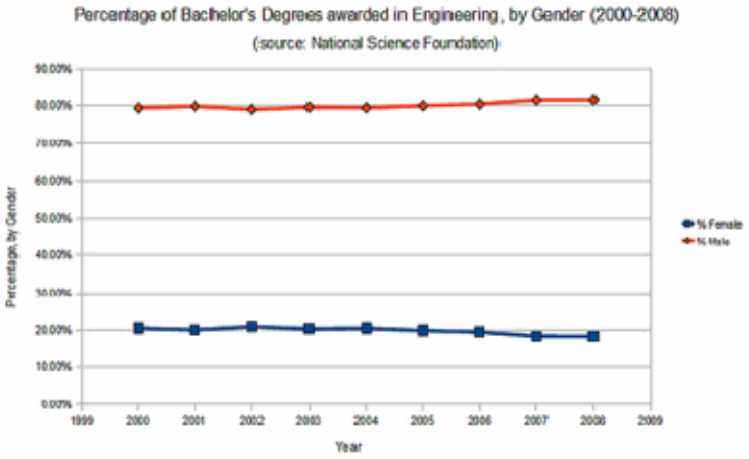
Thirty years ago, I was a college freshmen embarking on majoring in electrical engineering. I went on to graduate school at MIT (SM '86/ Technology and Policy/Electrical Engineering) where I met my husband, who graduated from the Doctorate program. I later returned to MIT's Sloan School of Management (SM 2001 in System Design and Management/SDM) when I had three children – a 2-year-old, a 5-year-old and 7-year-old.

Today that 7-year-old daughter, Mari, is an 18-year-old freshman majoring in Electrical Engineering (Course VI) at MIT. She shares many memories from my time at MIT. In fact, she keenly remembers watching the final robot competition in which I participated during the SDM program.

I have stayed in the field of electrical engineering / computer science since I first started on the journey. My choice to become an engineer was almost haphazard as I was never a tinkerer or a hacker. I was strong in math and science and that strength led me to pursue this career. Sensing a change in the air at the time, I felt privileged to be a woman in the field, forging my way for women behind me.

Although I contemplated leaving several times when my children were young, I have stayed in this career to this day. Of the few women that I graduated with at my university – about a dozen with almost five times as many men – I know of only one who stayed in the field.

Now I watch my daughter, who also seems to share the uncertainty that I once felt, embarking on a similar academic journey. Even so, I hear of fewer and fewer young women wanting to enter engineering as a career. I would have never dreamed thirty years ago, when I felt the doors open up so promisingly, that women would not be entering the field today. The graph below displays this static fact – and keep in mind, this is degrees awarded. I see many women drop out of the field after graduating.



Data from *Table C-4*, NSF Statistics on Women, Minorities, and Persons with Disabilities in Science and Engineering

For more details on the grim numbers, read this blog post with data from the NFS: http://www.adafruit.com/blog/2010/11/30/women-in-engineering-the-numbers/

Given these statistics, I decided to interview my daughter on why she chose engineering as her major, at least for now, and her plans to work in the field. We also shared our mutual experiences at MIT by answering the following questions together.

What made of you think of engineering as a career?

Mari	*Chris*
I was influenced by the fact that you and Dad were engineers. I was unsure what I wanted to major in but I had always taken lots of math and science classes in high school and enjoyed the content. My college counselor brought up engineering and I had exposure given my parents were both engineers and the more I thought about it, the more I was interested in it.	A guidance counselor also mentioned it to me. I knew nothing about it but at the time, I was interested in doing things that were not normal and being a female engineer was unusual so I wanted to go for it. I enjoyed math and science so I figured it was a good fit and I learn more about it as I studied in college.

You are in your first engineering class this term. What the ratio of M-F?

Mari	*Chris*
It's close to ½ and ½ — maybe a few more men. My computer science math class is more male heavy. 1:4. It's required and I think a lot of people that take the Intro Engineering class I am in now don't end up majoring. I have not noticed discrimination in my classes.	My engineering classes were mostly men – maybe a 1:5 ratio at best, and as the classes advanced, there were fewer women. In class some men didn't want to work with me or the women in the class.

Is there a difference between hands on programming experience between men and women in your classes?

Mari	*Chris*
I have noticed that among my peers in school, the men have a lot more experience programming. I've met only one or two women with a lot of experience.	In my day, computers and programming were still pretty new so even some men didn't have experience but there were many men that did and I knew of no women that had experience. I didn't have experience programming.
Mari	
I didn't either before I entered MIT.	

Do you think you will stay as an engineering major?

Mari	*Chris*
Course VI is one of the harder majors. If it is too difficult and I can't succeed, I may change majors and later fields. I feel middle-of-the-road now but the people below me will probably drop out and then I might be below average. I don't see myself as a programmer or a hacker. I don't see programming as the sole component of my career. It's kind of intimidating – especially at MIT – Course VI is hard and some people it comes so easily. I enjoy it, but sometimes I'm not sure if I'm cut out for it.	I loved all my classes the first few years but struggled my third year. I did not get good advising and took classes in an order where I wasn't ready for the content yet. When I started taking programming classes, I loved it and gravitated towards that. I did feel isolated but I wasn't alone. There were other women. You seem to have a very active SWE (Society of Women Engineers) chapter at MIT. I wish we had that – ours was not that active. I ended up staying in the field and went to a small company before you were born. When I got pregnant, they were not going to pay me for maternity leave. At the last minute (a few weeks before delivery), they decided to pay me ½ salary for 8 weeks. A few months later, a male manager got sick and was out for several months. They gave him full pay. That was probably the toughest company to work for. Many men got promoted around me. I finally left and other companies had much better atmospheres for women employees. Xerox is the best place I've worked so far. There is an atmosphere of equally promoting women, minorities, and all employees based on merit.

What about staying in the field after graduation?

Mari	*Chris*
I think I would like to do consulting and I'm even considering law. I would like to use my problem solving skills with my specialization in technology. I have familiarity with code and the technical aspects of the industry but I don't see myself as a designer.	I, of course, have stayed in the field and I really love the work that I do. I am a Software Architect and while I do some program, I also analyze features with the business team and decide how a feature will fit into our products. It's rewarding and challenging work and I'm very glad I stuck with this career. The experience I have now has paid off. It was the most challenging when my three kids were born. I was very torn about putting them in daycare and went back to work after 8 weeks with each child. I was breast feeding at the time too. It was very challenging and I also was not in a supportive work environment. But Dad really wanted me stay in the field and encouraged me. He told me all my education should be applied and I agreed.

Have you noticed any gender discrimination?

Mari	*Chris*
I don't feel there are any issues related to gender.	I certainly feel there are issues in the field related to gender. I think there should be way more women in the field. What about the programming contests at MIT? Aren't those mostly male?
Mari	*Chris*
Yes, you are right. And I just noticed that one of them was with "Pokerbots" – robots that play poker. I don't play poker.	I have an idea. Let's form an all female programming team next year during the programming contests during IAP (Independent Activities Period in January at MIT). I think alumnae can enter.
Mari	
That sounds great – let's do it!	

Mari and Chris at MIT in fall 2010

Hiroshi and Chris (before marriage) at MIT in 1985

Building the Computing Pipeline — One Talented High School Girl at a Time

by Maureen Biggers, Susie Cunningham, and Ruthe Farmer
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Susanna Bowen and Maureen Biggers

Beginning in middle school, Susanna Bowen taught herself HTML, CSS, and some basic PHP and MySQL. She has been using Linux as her primary operating system for three years! She admires the open source movement and all of the great programs that come out of it. One day, she hopes to become an open source contributor. One of her favorite projects was a Java applet she wrote to read musical notes from a text file and play them on a graphically represented piano. Her teacher reported that Susanna's "creativity oozed through her piano keyboard program." Susanna recently graduated from the Indiana Academy for Science, Mathematics, and the Humanities in Muncie, Indiana.

Winners of the 2011 Indiana Aspirations in Computing Award

Susanna is one of twenty girls to receive the Indiana NCWIT Award for Aspirations in Computing and was selected as a runner-up for the national award. She attended the January 19th Indiana award ceremony with her parents and her computer science teacher Susie Cunningham, where in addition to being recognized, she was able to meet other young women who share her interests and network with professionals in the field. Since receiving the Award, Susanna was featured in two articles in the Muncie Star. In addition, she was selected for other prestigious scholarships and awards that enabled her to attend her dream school, Carnegie Mellon, in the fall where she plans to major in computer science.

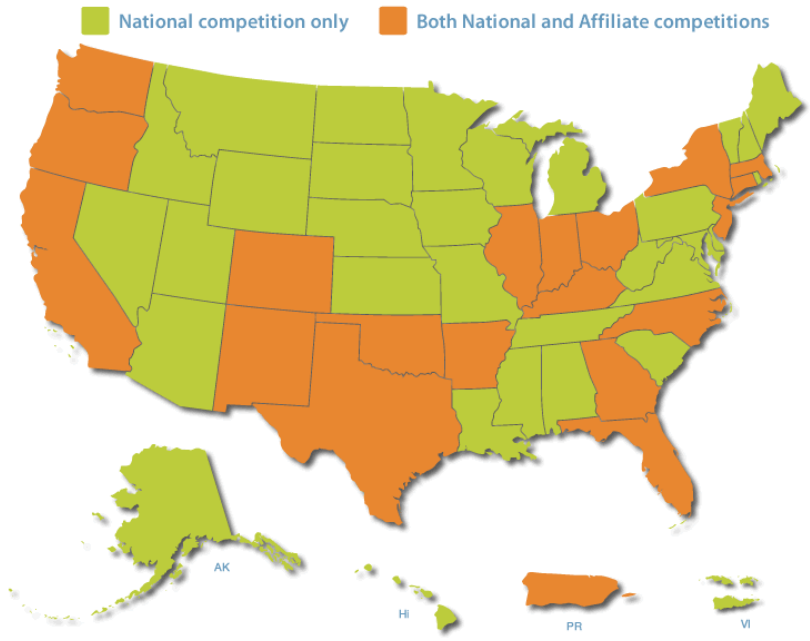
Unfortunately, interested and well-prepared young women like Susanna often don't choose a computer science major. Only 18% of computer and information science degrees were awarded to women in 2009 (11% at major research universities), though 57% of college degrees are awarded to women. (source: NCWIT By the Numbers 2010) The NCWIT Award for Aspirations in Computing is designed to reverse this trend by identifying, recognizing and supporting young women interested in and aspiring to pursue a major in computing.

> *"When we first learned about the Indiana Aspirations in Computing Award, Susanna grossly underestimated herself and thought she should not apply," says her teacher Susie Cunningham. "This experience was so good for her because it gave her the confidence and the way to say maybe I CAN do great things. Her Aspirations awards (Indiana and national NCWIT) led to more scholarship opportunities that now make it possible for her to attend Carnegie Mellon. Before this award, she would never even have applied there! I totally support this program and encourage all girls who like computing to enter in the fall. "*

Contrary to the name, the NCWIT Award for Aspirations in Computing is much more than an award program. Recipients are provided long-term support for their interests in computing through peer networking, mentorship, scholarships and access to opportunities.

Applications open September 15, 2011 for the 2012 competition. All high school young women residing in the US are eligible to apply for regional awards if offered in their area, as well as the national award. Girls, parents, and teachers should visit www.aspirationsaward.org for more information about both opportunities.

Regional award in your area? Go Local — Find the Talented Girls in Your Community



Award Programs around the United States

Founded in 2007, the NCWIT Award for Aspirations in Computing has grown to a combined National and Affiliate program with local awards serving 22 states in 2011. To date NCWIT has recognized 855 young women and plans to grow the award program to a reach of 10,000 young women and recognize 1,000 award recipients annually. In 2012, the program is on target to recognize more than 700 girls.

Affiliate hosts can be universities, corporations, K-12 organizations or a team of organizations working together.

Affiliates can be of any size, serving an entire state, a region or metro area. NCWIT Aspirations in Computing applicants represent a rich and ready source of young women highly qualified to enter the computing and IT workforce. Recognizing and encouraging their interest at this early stage could be the catalyst that propels them into studying computer science in college and ultimately pursuing a career in computing and information technology.

The NCWIT Award for Aspirations in Computing Affiliate Program leverages a network of over 300 organizations to recognize increasingly more girls each year by implementing the award locally. Providing a local experience builds direct relationships for girls with the universities they might attend, local educational enrichment opportunities, and the companies where they might intern or work — creating a clear career pathway in computing. The Indiana award, for example, was sponsored by nine Indiana universities and had support from more than 20 corporations and universities.

Hosting an Affiliate Award Program is fun, easy and rewarding!

Affiliate host organizations receive a complete toolkit for implementing the award program including:

- templates for publicity and promotion
- release forms
- guidelines for holding an award event
- access to the NCWIT online award application and review system
- technical support

For more information visit http://www.ncwit.org/award/award.host.html or contact aspirations@ncwit.org. ACM-W members are invited to engage with their local award Affiliate as volunteers, committee members, and application reviewers.

Our Research Experiences as First Year Undergraduates

by Alice Chien, Miranda Sheh, and Amy Le, University of Colorado Boulder
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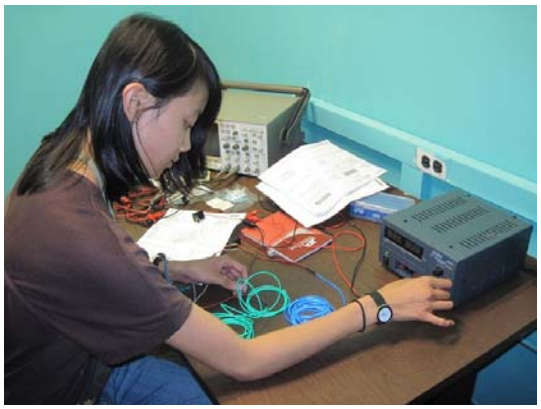
Side Note: After many successes teaching First-Year Undergraduate Engineering Projects classes at the University of Colorado Boulder, Professor Katie Siek and the Ph.D. students she works with decided that it would be valuable to provide first-year undergraduate students the opportunity to do research in their Wellness Innovation and Interaction (WII) Lab. During the Spring 2011 semester, three first-year undergraduate women worked in the WII Lab and did outstanding jobs assisting the Ph.D. students conduct their research. In this article, the three first-year undergraduate women share their experiences. After seeing how her Ph.D. students and first-year undergraduate students responded to these opportunities, she will definitely provide future opportunities to first-year undergraduates to collaborate on research in her lab.

Wearable Electronics and Computing: Alice & Miranda's Volunteer Research Experience



(L) Alice experimenting with EL wire; (R) Miranda soldering

Even before we had chosen our majors in the College of Engineering, we were immersed in a world of opportunities. Rushed to find a major and to not lose out on opportunities, we went to numerous talk sessions, panels, and workshops. At an industry panel, we constantly heard that first-hand experience is crucial in succeeding in the engineering world. Although a good GPA is important, it is not necessarily the deciding factor in finding an internship or job. As first-year undergraduate students, we also decided that we wanted to gain more out of the classroom learning. The Engineering Honors Program held a research panel in our residence hall composed of professors and students that allowed us to see that there are a multitude of opportunities for undergraduate students to be involved in research, even as first-year students. We were surprised to hear that professors are almost always willing to give freshmen with no experience a place to gain experience if the students are interested in the research and willing to commit their time voluntarily.

At this research panel, Professor Katie Siek spoke about her research in her Wellness Innovation and Interaction (WII) Lab with human-centered computing. We were interested in the research focus of her lab and later asked Professor Siek if we could join her research team. Through Professor Siek's lab, we discovered that our major, computer science, is not just limited to sitting in front of a computer and coding. Computer science can be applied to so much more than just programming software. Human-centered computing is a physical representation of computer applications to help humans live a better life. After a few meetings to discuss our interests and schedules, she matched us with her Ph.D. student, Swamy Ananthanarayan.

Throughout second semester, we worked with Mr. Ananthanarayan, experimenting with different electronic equipment and learning about electroluminescent wire (EL wire) to use for wearable technology. We met up each week to work and learn about different electronic concepts. During the rest of the week, each of us worked on mini-projects to help strengthen our knowledge of human-centered computing. It was exciting to be able to take materials

home and work on them on our own. Under his guidance, we learned about analog and digital waves. We also learned how to solder correctly and we were exposed to different machinery to help measure electric current. As we progressed through the semester, we came up with different ideas for what we wanted to do for our final project. We decided that we wanted a useful application for EL wire. After brainstorming several ideas, we decided to use EL wire to create a physical therapy device to help doctors monitor their patients' recovery progress by allowing doctors to see if their patients are doing their exercises on schedule and correctly. We also wanted patients to be able to use the device to gauge their own recovery process by allowing them to check whether or not they are doing the exercise correctly and log their progress.

To help fund this project, Professor Siek and Mr. Ananthanarayan were able to obtain funds by applying for the University of Colorado Boulder Engineering Excellence Fund. Later on, Professor Siek also found and gave us the opportunity to apply for a grant from the Collaborative Research Experience for Undergraduates (CREU) to work on the project through the coming academic year and the following summer as funded research assistants.

Through this experience we were able to see how concepts and ideas we were learning in the classroom are used in real world situations. This experience continues to teach us concepts that we will not experience in our classes until we are at higher levels. We have also learned about applying for grants and we will continue to learn about the research and design process through first-hand experience. This experience has been truly exciting because we are working on something that can be used in a real world situation as first-year undergraduate students coming in with no experience.

We had always imagined research to be students wearing safety goggles walking around in lab coats working in a quiet atmosphere. Although this environment is not bad, it was not the kind of research we wanted to do. What we found in the WII lab is that research can be exciting. Mr. Ananthanarayan said that the best way to learn about introductory electronics is from actually taking apart and breaking electronic devices. Mr. Ananthanarayan never acted as a traditional teacher; instead, he told us some basic safety precautions and allowed us to try running current through the EL wire ourselves, enabling us to have our own successes and failures. This way of teaching taught us more than a textbook or normal classroom setting ever could. This experience was also unique from classroom learning at a large university because the teacher to student ratio in our research experience was 2 to 1. This personal experience allowed us to ask questions and direct the learning to areas where we were most interested.

Our only regret in this research experience is not finding this opportunity earlier than second semester. We would have investigated opportunities and contacted professors after the first midterm of first semester. This project has helped us strengthen our knowledge of our major and given us a unique hands-on experience. We encourage every student to seek prospects for participating in research because such opportunities are frequently available. Not only is research experience a chance for students to find what they enjoy, but it is also an opportunity for students to discover what they dislike. This experience was definitely worthwhile. We are excited to work with Professor Siek and Mr. Ananthanarayan in the coming year and are deeply grateful for the experience they have given us. We look forward to learning so much more.

Fishing for Nuggets: Amy's Funded Research Experience

Amy Le

Like most first-year undergrads, I spent a lot of time wandering around campus; mainly because it was huge, and I couldn't find my next class. But even outside of class, I didn't really know where I belonged, or whether engineering was right for me. Everything was so new, so complex, and so foreign. I was looking so hard for something, anything… a tiny nugget that would give me some indication that I had picked the right major.

One of the first things I noticed was that emails are sent like there's no tomorrow. You read one campus update, and you've read them all. I was scrolling through my email late in the fall semester, aimlessly deleting Buff Bulletins left and right, when something just jumped out at me. This email narrowly missed a fate worse than death. The subject line read, "Invitation to Apply for the YOU'RE@CU Program." Turns out, this was a brand-new program aimed at first- and second-year undergraduates to give them a taste of what engineering is like: your own research experience. Applicants would be matched to a research project, and expected to work between 3 and 5 hours per week on research for school credit in the coming spring semester. The program promised that I'd get real research experience and be exposed to well-seasoned people in a variety of engineering disciplines. This was my nugget.

Amy skiing with members from the research lab

Nervous is a light way of putting how I felt before meeting my graduate student mentor, Danish Khan. The mere thought of meeting Professor Katie Siek rattled my socks. The program directors told me as little as possible about what I would be doing, who I'd be working with, and what they expected from me. I envisioned a group of extremely serious and humorless graduate students at the lab. In my mind's eye, I saw myself as a tiny blip in Mr. Khan's very complicated research project. I nearly fell out of my chair when I tried to call him Mr. Khan, and in response, he laughed at me and told me to call him Danish. Dr. Siek became Katie, and my discomfort was instantly relieved. They were the exact opposite of what I'd expected! We got along right away.

It took me a couple of weeks of reading papers and background information about his project before I could actually tell someone what we were up to, but I was immediately interested in the idea of using technology to help people improve their health. Danish had been working with a low-socioeconomic status (SES) population in Denver to help them improve their health. Since health includes many different factors and depends on a variety of issues, he had to focus his project on the snacking habits of this particular population. The main problem is that most technological interventions aren't designed with low-SES groups of people in mind, so not many can relate to or benefit from existing programs. My challenge would be to help him design and create four mobile-phone based prototypes that would encourage this group of people to snack more healthily. We based our designs on theories about how to induce lasting behavioral change: the Health Belief Model, Social Cognitive Theory, the Precaution Adoption Process Model, and the Elaboration Likelihood Model. We went further

than just by the books, though. I started volunteering with him once a week at the Bridge Project, an organization that provides tutoring in reading, math, and science for low-SES students from elementary through high school. I got exposure to the project from both the literature and the actual people these prototypes were supposed to benefit. This dual perspective was invaluable when it came to deciding what to put in the prototypes.

After we finished the prototypes, I was charged with performing a cognitive walkthrough on each prototype to inspect their usability. I adopted a persona for the walkthrough. I became Julia, a 31-year-old African American single mother of two children who uses her mobile phone regularly and has access to a computer a few times a week. At first, it was hard to imagine myself this way, but once I got started, things got rolling.

We must have come up with at least ten different ideas for prototypes, and I lost track of the hours spent taking apart each prototype and revising it. It was fun, though. I liked watching our projects transform over the semester, whenever we learned something new or realized we'd forgotten an important piece. Also, I started to see the bigger picture of what engineering was all about. The dull and mundane drone of day-to-day classes became more bearable because I could look past all of my general requirements to the opportunities they'd open me to in future research or in graduate school. If it weren't for this research experience, I wouldn't have stayed in engineering.

As the semester ended, it was a race to finish the prototypes, put a poster together, prepare a presentation about what I'd spent the past four months doing, and juggle finals. I didn't sleep much and had way too much coffee, but the last few days of school were the highlights of my freshman year. I had done meaningful work, learned a lot about research, and could see all the room I still had for improvement. It was exciting! I wouldn't change a single thing about my research experience, except that I wish I could have been a part of conducting some of the studies Danish used to collect more information about our low-SES population. There are more studies to be done, though, so the first thing I did after the school year ended was finish the required certification to help conduct the studies this summer. I feel excited and enthusiastic to continue working in this lab and to help finish this research project. Even though I only worked part-time in the lab last semester, I learned so much about research in computer science. Moreover, I finally found something I had real experience with in engineering, my nugget.

How I Survived My First Year in Graduate School

by Melanie Kambadur
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Melanie at a WICS Networking Event

I'd just completed the first year of my Ph.D. studies in computer science, and although it was a challenge to adjust to the changes, it was one of my most exciting years yet. Like many beginning Ph.D. students, I moved to a new university in a new town, picked an advisor and familiarized myself with a new department, made new friends, and began researching. For students who are curious about what the first year of a Ph.D. program is like, I wanted to share my experiences and some tips from this past year.

Settling into a new campus and a new place

I finished my Bachelor's degree in computer science last spring at Indiana University in Bloomington, and started my computer science Ph.D. a few short months later at Columbia University in New York City. Moving from a small college town (and my hometown) to a big city was a huge adjustment for me — I had to get used to public transportation, insanely high rent, and tons of crowds. The move was only the first of many changes though, because after

finding a home and figuring out how to navigate around the city and my new campus, I also had to acclimate myself to a new department. This meant meeting a new staff and getting to know the faculty. It also meant re-learning everything from where the coffee and bathrooms were located, to which printers I could use and which places were the best spots to take a nap or hold a meeting.

Getting to work

After I got used to my new home, I had to get used to a new work schedule. As an undergraduate or Masters student, most students spend the majority of their academic time focused on classes and homework. As a Ph.D. student, the expectation is that you will spend much of your time researching. I spent a little time during my undergraduate years on research, but not nearly as much as the minimum 50% required by my new computer science department. The 50% requirement did not sound difficult to me when I first started the school year, but it didn't take long for me to discover that there would be more distractions than I originally expected. First, there are still classes. It is pretty standard that Ph.D. students take at least two classes for their first few semesters. This might sound trivial, but graduate classes are usually fairly time-intensive, and there is an extra element of pressure for Ph.D. students because of the expectation to earn high grades; at Columbia for example, we need a B+ or better for credits to be counted. Classes were only one of many distractions that I encountered, though: I also had a few semester-end comprehensive exams on core computer science topics to prepare for, and after only a couple weeks on campus, I found my calendar filling up with countless appointments. Between class lectures, lab meetings, technical talks, reading groups, class study groups, appointments with professors, and club meetings, there were days when I barely had any time for research.

As an added challenge, I had to pick a research advisor this year. Choosing an advisor was complicated, because I had to consider professors' research interests, their experience, how often they were available and willing to meet with students, their funding resources, and many other factors. I thought about many of these factors before even choosing a graduate school, but I still found myself with four potential advisors when I arrived at Columbia. Since all four had many of the qualities I was looking for in an advisor, I had an especially difficult time choosing whom to work with. I tried to talk to and spend as much time as possible with each of the professors in my first semester. Ultimately, I chose to work with a fairly new professor, Martha Kim. I chose her in part because of her enthusiasm and also because I felt very comfortable discussing my ideas with her. I think she will be a great mentor!

Not all schools emphasize research so heavily in the first year of a Ph.D., but despite the other commitments, I was actually happy to jump immediately into research — it's why I wanted to do a Ph.D. in the first place. If you haven't done any research before, you can expect to spend a lot of time reading papers, discussing and thinking about ideas, and learning and experimenting with new tools or languages. You may be spending a lot less time writing code than you might have guessed. Even though I had done research before, I was still surprised by some things as I began researching for my Ph.D. One difference was that professors didn't know what to expect in terms of my education and technical experience. This is because Ph.D. students come from such a wide range of backgrounds; some have worked, some have already completed a master's degree, and some, like me, have come straight from their undergraduate degree. It was easy to tell professors when I knew more than they guessed, but a lot harder to admit when I didn't know something they thought I knew. It was worth the mild embarrassment though; every time I admitted to not knowing something, I got the opportunity and the time to learn something new.

Another surprise was the amount of respect I got from faculty as a Ph.D. student. I was well-treated as an undergraduate, but it has been fun to become a colleague of my professors'. As an undergraduate you are often seen as someone who needs help, but faculty-graduate student relationships are more mutually beneficial. Finally, I was surprised by how difficult it can be to measure progress in research. As an undergraduate, I got a lot of feedback from assignment grades and exams, but as a beginning Ph.D. student, I have had trouble gauging how I am doing. I learned to get frequent performance evaluations, even if I had to ask for them. It was a little scary to ask professors what they thought of my work, but I figured it was way better to hear early on that I needed to work harder than to hear at the end of the

semester that I didn't perform up to expectations. My intuition about checking in early and often was correct; I now know more than one student who has quit their Ph.D. after receiving upsetting end of the semester feedback from their advisor.

Building a life outside of school

Melanie making time for herself at Times Square

I have heard time and again that a Ph.D. is a marathon not a sprint, and I can already see the wisdom in that advice. All the new work and expectations make it easy to let academics dominate your life, and can tempt you to over-work. That's not to say hard work isn't necessary; most Ph.D. students I know work significantly more than a 40 hour work-week, and I have certainly worked more hours in the last year than any other year of my life. The trick is not to work to the exclusion of all else, because you want to be able to maintain your work schedule throughout all the years of your Ph.D. Also, for me, working more hours does not always mean I get more work done. For example, when I make time to exercise and sleep well I find that my productivity goes up, because being healthy makes me work more efficiently throughout the day

Making time for a social life has been important for me this year as well, because a Ph.D. is a long time commitment. I am investing five or six years of my youth in a Ph.D., and I don't want to give up all the fun. Moreover, I know that having friends means I will have emotional support in difficult times. I left behind most of my friends when I left my undergraduate school, and I thought it might be hard to make new ones. While I certainly have not replaced my best friends yet, being at a university has made it easy to meet new people. I got to know some of the other Ph.D. students in my department, and it has been a big relief to have people to talk to who understand the situations I am going through. Computer Science Ph.D. students are a fairly diverse crowd, probably more so than most undergraduate computer science student bodies. As a result, I have had a lot of fun meeting more international computer scientists and more women computer scientists this year, particularly through our Women In Computer Science group. I have also had the opportunity to meet a lot of non-computer scientists and non-Ph.D. students through university clubs and activities. In this respect, I feel lucky to be doing a Ph.D. — if I went straight into the workforce I suspect I would have had a much more difficult time making new acquaintances.

Looking ahead

Hopefully nothing I've shared has scared anyone out of starting a Ph.D. program. Although I admit that this year was a difficult one, I am very positive about the rest of my studies, and definitely happy about my choice to pursue the degree. I have loved having the opportunity to meet new people and learn new things, and I am excited about the new ideas I am starting to develop. I can't tell you for sure until I've graduated, but from my experiences so far, I expect that my years as a Ph.D. student will be very rewarding.

Information Technologies in Spain: Why a Profession for Men?

by Luis Fernández-Sanz (Universidad de Alcalá) and Miren-Idoia Alarcón-Rodríguez
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We present a brief review of the present situation regarding female representation among Information Technologies and computer professionals, especially in Spain. We comment on some of the data which is relevant to our analysis of this situation along with various studies and opinions from Spain and other countries. Inspired by the results of our analysis, we started a plan to know more about possible reasons for this situation. This paper presents results of a pilot survey with a small sample of Information Technologies (IT) professionals to

collect their believed reasons for the under representation of women in the profession. Finally we look at the European Centre for Women and Technology (ECWT) initiative and the role the Spanish Council of European Professional Informatics Societies (CEPIS) Asociación de Técnicos de Informática (ATI) play in it.

1 Introduction

The title of this article was intended to draw the attention of readers to the fact that women are currently under-represented in the technical areas of the Information Technologies (IT) profession and in official IT-related studies. In fact, careers in IT have ended up being a predominantly male affair, since the number of women involved is clearly lower than might be expected. But we also want to know why.

A survey-based study [1] puts female representation in IT jobs in Spain at around 20.4% for technical professionals, although there are greater percentages of women in activities which are not so strictly technical in companies and organizations engaged in information technologies such as marketing or quality. According to the latest study of the sector made in 2009 [2], women represent 36.8% of all employees in 2009 (in 2008 the figure was 35.0%), mainly due to the fact that women only suffered a 1.1% loss of jobs in absolute terms, while men lost 8.3% of their number. As the same study shows, the destruction of jobs was worse among those without a university degree since there have been half the number of recruitments and 10 times the number of redundancies. Since the percentage of graduates is 70.4% compared with 55.7% for men, it is easy to see how the overall percentage of women in the IT profession grew as a result of the lay-offs. In Europe [3], the figure for 2004 varied between 5% and 30% of all professional women in ICT. This figure does not necessarily have to coincide with the number of women included in all areas of the sector as a whole: in fact, for Spain in 2004, the figure is 20%, which does not tally with the overall figure of close to 35% given in the series compiled by the Spanish Association of Information and Communication Technology (Asociacion Española de Tecnologías de la Información y Comunicación, AETIC) [2]. (AETIC is the main association of IT Companies in Spain, representing about 90% of the workforce.) More specifically, the National Institute of Statistics (INE) figures, when restricted to classification category 72 (Informatics activities) companies, show the overall percentage at 24.7% and the category 642 (Telecommunications) figure at 37.1%.

Unlike other professions, in which the passage of time seems to help correct possible imbalances of this nature, the informatics profession does not appear to be heading in this direction. Unfortunately, judging by the percentage of female students pursuing degrees in computer science, it would seem that there is little prospect of this proportion changing: INE data confirms that, in the academic year 2008-09, only 16.1% of students following computer science degree courses were women, while 14.38% of the new intake of students were female. In the academic year 1998-99, 20% of enrolled students and 17.18% of the new intake were women. In short, the decline continues.

In the USA, the National Science Foundation found that the percentage of women graduates in IT-related subjects dropped from 34.5% in 1985 to 22.2% in 2005; apparently this was the only technical field in which the percentage of women students had decreased since the '80s in the last century. In Europe, a general problem of attracting young people to scientific and technical subjects had already been detected. According to Eurostat, in the field of sciences, mathematics and informatics, the percentage of women graduates has fallen from 42.3% to 39.2%: in Spain the decline was greater — from 43.1% to 36% — while in some countries, such as Austria, the proportion has increased. However, a more detailed analysis in Spain, limiting ourselves to official data from INE, shows the evolution between the academic years 1998-99 and 2007-08 (see fig. 1).

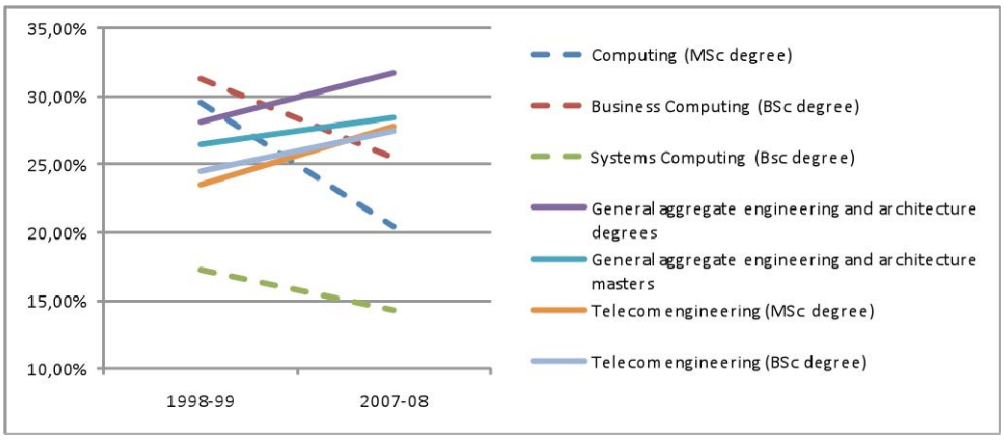

Fig.1: Evolution of percentage of female students in Spain in different degrees

As can be seen in the figure, dotted lines (corresponding to the three specialities of computing degrees) show a clear decrease in female students while general figures for the whole area of engineering, or for a closely related area such as telecom engineering, reflect increases in the presence of women.

This might lead one to believe that the problem stems from the teaching at universities or even from the recognition given to university degrees. However, if we analyze data regarding enrollment in IT-oriented middle and higher level vocational training courses from 2001-02 (from 2003-04 for medium level) to 2007-08 (see fig. 2), it seems clear that the situation is generally the same for all kinds of IT-related official training. This trend is only applicable to computing/IT training. Other technical branches have not exhibited similar behavior.

2 Reasons for an Analysis

Of course, there is no reason why a profession should have to be balanced in gender terms. A recent paper stressed the need to take a fresh look at some aspects which much of the research into this phenomenon has failed to question adequately [4]. It is, in fact, a good work of critical reasoning aimed at avoiding bias in studies by rejecting statements that are unsupported by research or data (like those mentioned in the cited paper or the ones in a national semi-official document [5]). The paper also poses another question: is it so important to try to understand this imbalance when the same thing occurs in other key professions such as nursing or education in which efforts have been made to attract men?

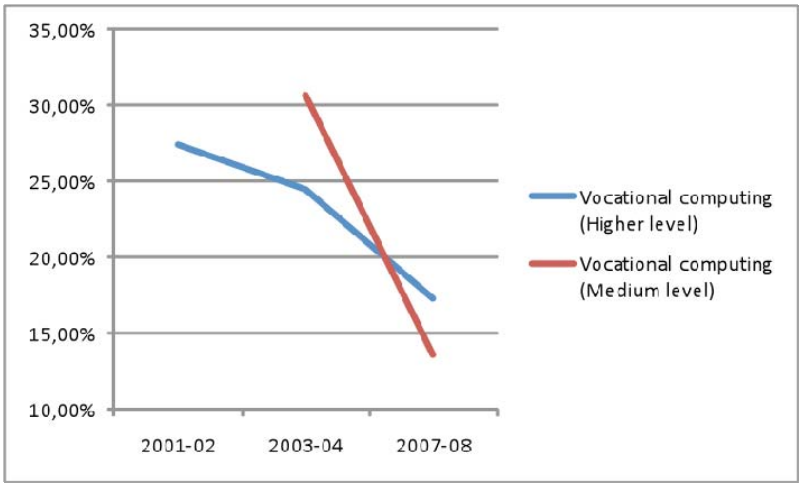

Fig.2: Evolution of percentage of female students in Spain in vocational training

It certainly opens up an interesting line of research which is difficult to cover in a brief article. However, in our view from an association of IT professionals, we believe that a number of different factors emerge in the field of informatics which emphasize the importance of this imbalance and make it worthy of closer examination. We provide a number of (not necessarily exhaustive) examples below.

Generally speaking, professions based on creativity and knowledge are especially reliant on drawing from a wide range of talent in order to achieve the best results in terms of effectiveness and innovation. The work to be performed (of an eminently intellectual nature) does not involve any constraints which might hinder the participation of women, such as activities requiring considerable physical strength, nor is it a profession with a long tradition of having been dominated by men in which there are greater mindset or image barriers to the incorporation of women. In fact, women with skill and perseverance have broken into many traditionally "masculine" professions. A case such as information technologies, with a much shorter history than other professions and even than the vast majority of technical disciplines, is especially disturbing: it is gradually becoming a male profession due to female candidates clearly shunning IT as a career since, as we have seen, the percentage differences were not so significant a few years ago.

Also, there does not seem to be any pressure to discourage the incorporation of minority groups, rather the opposite. In fact, employers regularly complain of a lack of skilled personnel, now perhaps mitigated by the general crisis affecting Spain and Europe. In short, the informatics profession needs new members to meet the needs of companies and society and, conversely, fails to attract (or even retain) in any significant manner half the available population: women. It cannot be enough to console ourselves with the fact that the same thing is happening in other countries, to various degrees and under the influence of different local circumstances. Especially when in those countries, and in general since the creation of the European Union, efforts have been made to analyse and help correct this imbalance, one which has no logical justification beyond factors which could be mitigated or corrected in the various social, educational, economic or political environments. The possibility of there being an "innate" factor would seem to be ruled out as a single reason (although it would be fascinating to address this aspect as in [6]), since the percentage of women has been decreasing over time from significantly higher levels.

3 Analyses and Studies

A recent study [7] found that, in the world in general and in all sectors, women have a broad perception of professional success (59%). Surveys conducted late in 2008 on 3,600 professionals of either gender (split 50-50) in 18 countries, with a third over 45 years old and a third under 30 years old do not reveal any major differences in the perception of the handling of technology by women compared with men. However, if we focus on the technological sector, this appears to be in contrast to the professional under-representation of women: a phenomenon which is generalized in developed countries and does not seem to improve with the passage of time. In the United Kingdom the percentage of women shrank from 24% in 1997 to 21% in 2004, while in the USA the figure has dropped from 41% in 1996 to 32% in 2004 [8]. As mentioned before [1], the percentage of women in technical departments in Spain was only 20% while total in the IT sector was 34.5%: similar to the national average in other sectors but concentrated in marketing and customer care.

One of the problems, therefore, is the difficulty to attract women onto informatics degree courses, while there could also be a high drop-out rate or a lack of performance. In a recent study in 8 Spanish universities [9], it was found that there were no significant differences between the academic performance or drop-out rate of the two sexes; the only (slight) success correlation relates to the entry grade. This study confirms the gradual decline in the percentage of female students in each new intake which was seen in an earlier study [10]. The personal teaching experience of one of the authors of this article is that, between the years 1989-1994, 25.4% of all students in his computer science courses were women when now (academic year 2008-09) the figure is approximately 16.9% at the same university.

It is curious then that companies complain about a lack of talent or qualified personnel to meet recruitment demands in recent years. Although the current crisis may have mitigated this pressing need, the problem is likely to reappear in an even more virulent form once the job market rebounds. In this scenario it is strange that such a large percentage of high-level talent cannot be drawn towards a technological field so important for the development of countries and the economy in general.

Strangely, some experiments with informatics students [11] have revealed that, without access to data identifying the candidate, a female CV is preferred to a male one. Although there are some important exceptions in the senior management of some IT companies, it is also true that there is still a need for more women in top management positions in the sector (boards of directors are still only 22% female and executive committees only 19%). However, a study [12] suggests that, in principle, women do not perceive the existence of a generalized glass ceiling, so it would be wrong to suggest a dissuasive effect. On the contrary, different reports based on findings not supported by data tend to attribute these differences to policies which discriminate against women. Nevertheless, it should be remembered that in Spain, although there may be good professional prospects for a specific course (at least compared to other degrees), students tend to choose their major mainly (78.9%) on the basis of vocation [13].

In any event, some interesting specialized papers [11][14][15] have been published with a view to increasing both enrollment and retention of students until graduation. According to the authors, the matter of retention is vital since, in a study conducted in the state of Virginia, there was found to be a very significant drop-out rate among female students. The proposed recommendations are very varied and range from working with high school teachers to carry out outreach activities, to the idea of maintaining stability among the teaching staff (!) since statistics appear to demonstrate that an excessive turnover of teaching staff causes a higher drop-out rate (an interesting idea to convey to the heads of managers of certain universities). Also stressed is the need to create a more favorable environment for the women, in such a way that they can see successful role models in the IT industry.

However, such policies aimed at attracting students to computer studies may end up adulterating the curricula to make the subject look less like computer science by focusing on its practical applications in other fields and so encourage more women to enroll [16] [17]. One explanation for the lack of female interest is the gap between what is taught and its application to day-to-day life, a reason which applies not only to the women but also discourages young males. Associations like ACM and IEEE have created awareness campaigns to mitigate the general lack of interest in informatics degree courses combined with national campaigns to attract students to technical majors.

However, the problem seems to arise earlier, when the potential students are in their teens which is when future study decisions are taken, and tastes and career choices firm up. Among the factors which influence young people's decision to forgo engineering courses in general is the number of years it takes to complete them in Spain, which seems to have an especially negative impact on the presence of women in the case of computer studies [18]. It would appear that teenage girls start to emotionally reject computer-related courses when they are between 15 and 18 years old when they start to perceive the target professions as masculine [19].

Some initiatives in the USA include having young female graduates give presentations in high schools aimed at providing better information about the informatics profession and related degrees. Although better information does not always have a positive impact on forming vocations, this is not an especially important reason to explain the low rate of female enrollment, or even of enrollment of either gender, in informatics courses. Also, the influence of the stereotypical view of computer workers as *geeks* or *freaks* (with their general weirdness and traditional lack of social skills or fashion sense) can only be a general cause for shunning informatics courses, not exclusive to females, since women have broken into other professions (e.g., areas related to the building sector such as architecture and civil engineering) with stereotypes that are socially much less acceptable.

In other cases, this general lack of professionals and, more particularly, of female candidates is put down to the profession's poor image in terms of working conditions. Although it is true that informatics students and graduates are famed for their 'whining' about pay and conditions (when comparative studies with other degrees suggest that informatics graduates are significantly better off than students of other disciplines, both in terms of job opportunities and starting pay), it should also be recognized that there are real grounds for complaint. In particular, difficulties in reconciling work and home life which are typical of IT jobs and which especially affect women (normally more involved in meeting the needs of family life) due to a more traditionally "male" concept of work, typified, for example, by "presenteeism" in the workplace.

We say "typical of IT jobs" because, since the late '80s, the authors have personally had the opportunity to hear, from IT professionals, stories mentioning weekends working at the office to finish a development project, companies which send out for pizzas or call catering firms for dinner because their employees need to stay late to finish a project, regular calls at unsocial hours to "put out fires", etc. And on top of everything, all this effort is unpaid and you still have to be at the office the next day at 8 o'clock on the dot.

These stories and stereotypes have grown deep roots in our society and even appear in films, TV series, and novels. The atmosphere thus created combines with the awareness that many of these situations occur because there is not enough investment in methodologies, tools and training, and that companies make unrealistic bids to win contracts. Even so, studies sponsored by European authorities (concerned with the great lack of people skilled in technologies) reveal that reconciliation between work and family life might not be such a major problem if women have the ability to manage their own time [19]. IT work actually lends itself better to teleworking but nevertheless has a reputation for requiring long "office" hours because teleworking opportunities are not adequately exploited. Another influence is the syndrome of self-imposed overtime (presenteeism) due to the seductive and exciting nature of working in technology, which women may also suffer from [19].

Working in IT increasingly requires multi-disciplinary teams, so intensive training in informatics may not be essential for everyone (although the minimum necessary skills are). In fact, many women whose original degrees are not IT-centric join the profession after career changes and get great personal satisfaction from the work they do and the professional success they enjoy [20], which appears to contradict the problem of attracting women to IT-related professions. Moreover, the unregulated nature of the profession, with a tradition of low union membership and little job protection, can also give rise to situations of inequality, especially among minority groups in the sector like women.

4. A Pilot Survey to Discover Reasons

Conscious of the panorama described above, *Asociación de Técnicos de Informática* (ATI), the oldest (since 1967) and largest (more than 3000 members) association of IT professionals in Spain, took up the charge to manage the National Point of Contact (NPOC) of the European initiative ECWT: European Centre for Women and Technology (www.womenandtechnology.eu). As part of the activity of NPOC, we conducted a pilot survey, in early 2011, of a small sample of IT professionals from the Women and IT working group of ATI. The underlying idea is to experiment with the survey design and analyze results, keeping an eye on our ultimate goal of launching a European–wide study (with the help of the rest of NPOC of ECWT, as they have expressed their genuine interest in contributing to this project).

The survey was supported by an online system based on Limesurvey software. In the first section, we anonymously collect profile data from participants.

- Gender: a few men are also involved in the ATI working group
- Years of experience in IT profession and in current position
- Position
- Activity sector

After this first section, we include questions intended to collect their opinion on different aspects of the profession as well as on the possible influence of different factors to explain low numbers of IT female professionals.

4.1 Sample

As this is a pilot survey, we have not pretended to encourage participation of a high number of people before having the opportunity to refine questions and design of the online questionnaire. The sample size of professionals which completed participation in the survey was 14. Profile data are summarized below:

- 10 women and 4 men.
- Average experience as professionals: 19.8 years; in current position: 7.6 years.
- Positions: varied, including two teachers, two project leaders, two analyst-programmers, one manager, one consultant, etc.
- Sector: three government or public administration, one transportation, five in IT services, etc.

4.2 Results

The first set of questions were designed to elicit the participants' view of their profession and their level of personal satisfaction in their career. We used a customized Likert scale for each question.

Question 1: Satisfaction with the profession:

- Low: 2
- Neutral: 1
- High: 8
- Really high: 3

Question 2: Satisfaction with the profession when comparing with other professions:

- Lower: 3
- Equal: 5
- Higher: 6

Question 3: I chose vocationally to be educated in IT before starting my professional career:

- Yes: 11
- No: 3

In general, professionals are satisfied working in IT (78% high or very high), they report better working satisfaction than in other possible professions (78% equal or better), and they chose to be IT professional when they decided their education elections. No important differences are found between men and women: of course, this sample is too small to draw conclusions. The information on satisfaction is important to see if women and men might have reasons for complaining about the profession, so their opinions about reasons of low female presence might have been biased by general dissatisfaction.

The second set of questions asked the participants' opinion about reasons for a low presence of women in IT profession. Possible reasons offered to participants are:

- R1: Masculine image of the profession
- R2: Lack of promotion of success cases of women in IT

- R3: Engineering-like image traditionally associated to masculine role
- R4: Freak-like image of the profession as projected in media
- R5: Poor social image and lack of consideration of the profession
- R6: Business model tends to promote competition based on low prices which lead to poor working conditions
- R7: Working conditions are specially hard
- R8: Family and professional life conciliation is specially hard
- R9: Not attractive remuneration, specially at the beginning
- R10: Bad image in the media
- R11: Discipline highly stereotyped in the secondary education
- R12: Poorly explained in secondary education
- R13: Still influenced by the crisis of dot.com
- R14: Profession not regulated or not restricted by qualifications controls

It is important to note the following:

- We compiled the list of reasons after reviewing studies and opinions expressed in social networks or forums, as well as suggestions given during an informal meeting with a small group of female students studying computing.
- Some reasons are genderless, i.e., they correspond to general obstacles to entry in the IT profession.
- R14 was significant in Spain due to the debate about changes in the regulation for accessing the profession.
- Participants were requested to indicate their opinion (yes, neutral, no) for each reason in the following aspects:
    - If it is something that really happens
    - If it influences the presence of women
    - If it would be similar in any other profession: i.e., it is a general situation for all professions.

Results are shown in figures 3, 4 and 5 in terms of answers by all the participants, for women and men.

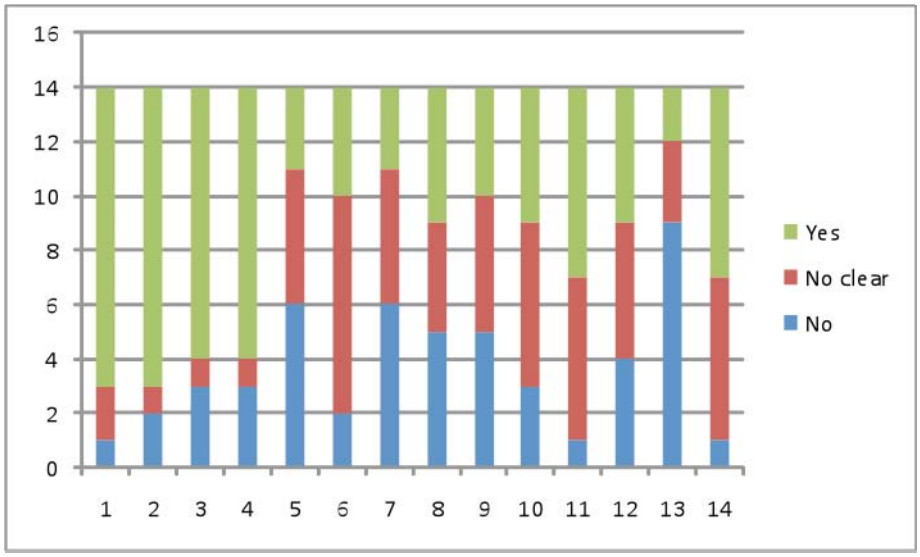

Fig.3: Opinion on real occurrence of causes

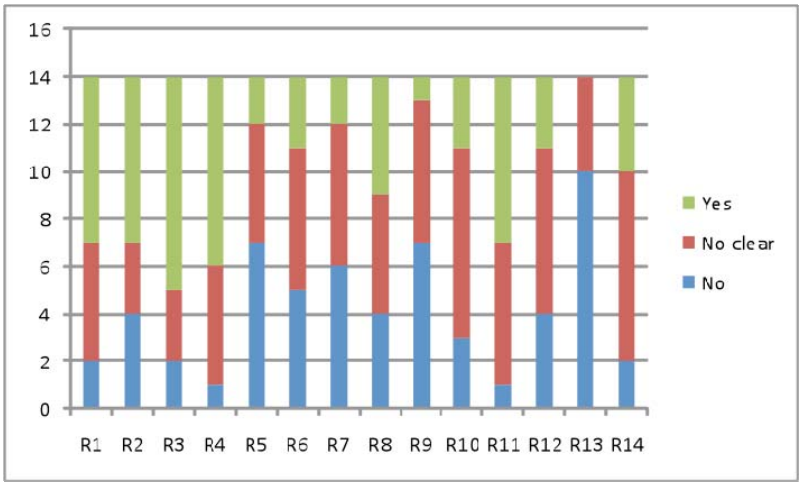

Fig.4: Opinion on possible influence in presence of women

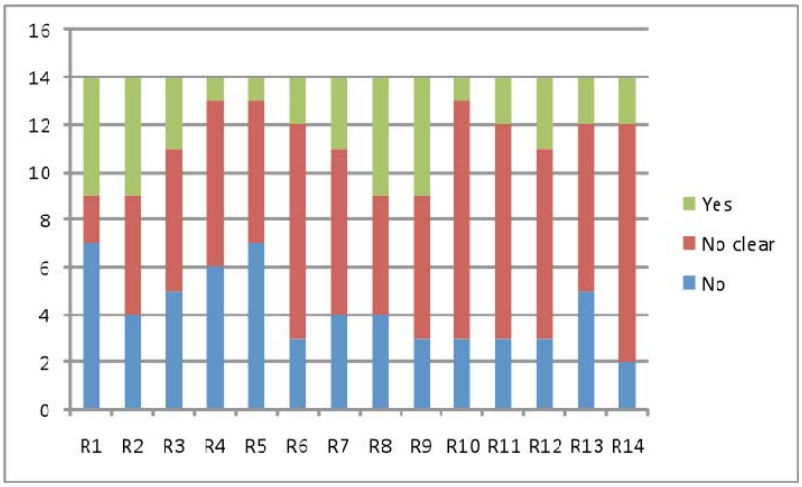

Fig.5: Opinion on similar situation for other professions

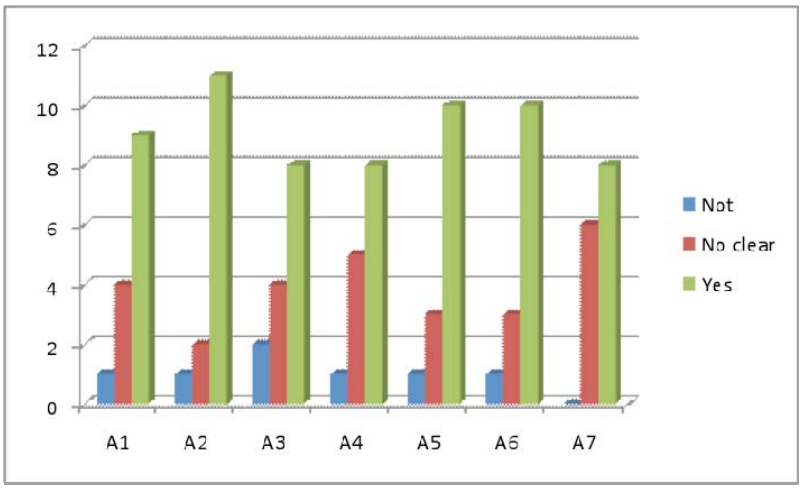

Fig.6: Opinion on possible actions

For the purpose of gaining insights for the possible causes of the low percentage of women in IT profession, the most reliable ideas come from reasons which have a high score in Fig. 3 (they are real) and Fig. 4 (they influence presence of women) while having low score in Fig. 5 , i.e., they are not a general problem of all professions. For example, the first four reasons seem to comply with the above criteria, suggesting solid reasons for the situation are masculine image, lack of dissemination of female success cases, engineering-like image and

freak-like image. However, R13 is totally rejected as having any type of influence in the presence of women.

The final set of questions aims to collect the opinion of participants about the possible value of several possible actions as instruments to improve the percentage of women in IT profession. We suggest the following actions to be rated with yes, not clear or no:

- A1: More information about IT profession
- A2: Dissemination of cases of professional success of women in IT
- A3: Actions of awareness in recruiting and professional career about female under representation for HR departments
- A4: Specific actions of professional training to facilitate incorporation of women with no regular IT education
- A5: Actions of awareness of organization for implementing conciliation and flexibility policies
- A6: Actions of awareness in secondary education
- A7: Specific studies to find out more precisely causes and possible solutions for the situation

Our results are summarized in Fig. 6.

Except in the case of A7 (studies on causes and solutions), participants tend to agree with the actions suggested.

5. Conclusions and Future Actions

Although in the previous section we presented some of the aspects which are being examined to understand the reasons behind the low female representation among IT students and professionals, there are no reliable conclusions to be drawn from existing studies. We have started a process to collect opinions on possible causes from IT professionals, to reflect quantitatively the feeling of people really involved in the profession. Once we know these reasons, we will be able to devise specific actions involving different stakeholders. Our ultimate goal is to prevent intellectual female talent from being lost to a discipline and a profession that is destined to play a vital role in the progress of our society.

As the leading IT professionals association, ATI naturally wants to do something to address this situation. We requested and were awarded the job of coordinating the national contact point in Spain of the *European Centre for Women and Technology* (ECWT) initiative (http://www.womenandtechnology.eu) to drive and lead contributions made in our country to increase female presence in our IT- and knowledge-based economy. With the support of all members of ATI, and in particular women, our association hopes to provide new solutions and better analyses to ensure that the greatest possible proportion of female talent takes part in the forward movement of the IT profession, yielding a better service to society.

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Embodied Interactions

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This article discusses developments in interactive artwork happening as a result of collaborations between artists and engineers/computer scientists. It describes work that is currently being developed for two digital art exhibitions in the UK and highlights the difficulties that women artists face in trying to find female collaborators with electrical and IT skills. The article will present recent academic research which has been looking at ways in which creativity can be supported by digital technology. It will explain one particular project which has engaged two women artists in collaborative digital art making and provide visual examples of some of the artworks that have been created.

The ubiquity of information appliances and digital devices in every aspect of our everyday lives has led to ever greater expectations of the artifacts we surround ourselves with. We anticipate that they will provide embodied functionality, contain integrated electronics, communicate, transmit or record data. It is not surprising therefore that many artists are exploring the potential of new processes, machines and methods of interacting with their audience.

As an artist who is interested in physicality and sensory experience, the potential of embedded and embodied technology within artworks is incredibly exciting. However, it is also frustrating without the expertise, time and mental energy to be able to work competently with electronics and manipulate software. My desire is to collaborate; to find like minded people who would be willing to cooperate and co-design with me. In this article I hope to explain a little about my work as an artist and to seek any like minded computer scientists or electrical engineering experts who would like to get creative and break new ground. *Are you interested? Could that be you?*

'Woman' Treadaway and Bell collaborative digital print

I have been working as an artist in the applied arts since the early 1980's and have experienced firsthand the delights and challenges of integrating digital technology in my creative processes. As a woman artist working with technology I have encountered all kinds of preconceptions and prejudices over the years. I believe women are pragmatic in their appropriation of digital tools. We like them for what they will do for us. We don't necessarily need to know how they work nor have any deep desire to control the code. They are a means to an end. These are sweeping statements, as any gender specific comment is likely to be — there will always be exceptions. These assertions however, arise from years of experience of working with women in art education, business and research. It seems to be a fundamental perspective, possibly rooted in our innate nurturing instinct, which prioritises the pragmatic use of tools and machines. We want to use technology to make life easier, to complete the task in hand for practical reasons; we are less interested in technology for its own sake but more for what it helps us to achieve.

When I first started working with computer aided design (CAD) in 1982 the field was dominated by men and it was unusual to find women interested in using technology. Although I found I was adept at operating the machine and was beginning to create artworks, I was constantly told, by male colleagues, that to be truly creative I would need to be able to program the machine myself. I had neither interest nor capability for doing this — I am an artist first and foremost and numbers have never been my skill set. This male attitude to working with the technology seems to have shadowed my creative career. I don't think I have ever had this kind of response from a woman.

Both my MA degree and PhD involved using digital technology and now I am an artist/ researcher working on projects that investigate how technology can support creative visual art practice. My most recent project involves collaborating with a computer scientist/ engineer who is working with me to make my artworks interactive. Finding someone to work with in this way has proved to be very difficult and I am very grateful to Mark for his interest and his help in the project. My search for a collaborator included contacting the ACM and I was amazed that despite the world wide scale of the association I got only one response which went nowhere. In the end I decided that I would have to learn electronics myself and signed up for a weekend Arduino course at a local arts centre. I was the only woman in a class of 25.

The gender knowledge gap was immense. Most of the other (male) students seemed very familiar with the basic electronics and open source programming we were taught. I struggled to keep pace although was delighted at the end of the course to produce a successful working interactive artifact. The whole experience left me feeling very aware that women feel very disadvantaged when working with technology. I decided, that weekend, that what I needed was a collaborator and Mark Heseltine came to my assistance. As a fellow arduino student we could both talk the same language and understood the potential and limitations of the technology. The works we are currently making will be exhibited in 'Momentum' an exhibition of digital artworks to be held in Crafts in the Bay in Cardiff, Wales, from September to November 2011 and at the Collins Gallery in Glasgow, Scotland from January to March 2012.

The artworks comprise a series of 3D digitally printed drawings which are a visual and poetic expression of sound. The drawings were made using a haptic tool with Freeform® software and were printed in starch using a ZCorp digital printer. The works were inspired by a specific shoreline location and the physical experience of being there. The interactive element will introduce another sensory dimension to the works; they will respond to touch creating sound

and vibration, enabling the viewer to perceive more of how it felt for the artist to be in the location where the drawings emanated.

'Porthledden' Treadaway, 3D digitally printed starch (sound drawing)

Coastal locations have informed much of the artwork I have created over the last five years. The 'Shorelines' research project is a collaboration with the Scottish textile artist Alison F Bell and has been investigating the use of digital technology in a collaborative art making process. A series of artist's residencies in coastal locations in England, Scotland, Wales and Australia have been used to generate imagery for a collection of large format digitally printed artworks. These have been created by exchanging layers developed using Photoshop® software. Each layer represents an individual memory of the experience of being in a particular location and the final printed images contain numerous iterations. The layers comprise digital drawing, scanned hand rendered watercolour sketches, stitched fabric and photographs. The beauty of the technology is that it makes it so easy to blend images generated from different source material together. The most difficult part of the creative process is knowing when to stop; images can easily become over complex and difficult to read visually. Memory plays an important role in the discriminating and decision making process. Remembering how it felt to be in the location; the smell, sounds and even taste of the air help to conjure a mood that can be translated through colours and lines into expressive pictures on a computer monitor. These images have been translated digitally onto a variety of substrates including paper, textiles and glass.

'Sandscape' Treadaway and Bell collaborative digital print

The collaborative process has been particularly fruitful due to the developing empathy between both of us. This has evolved over time and as a result of the shared experiences of being in the specific locations. These collaborative works, along with other pieces created independently but related to the theme, were exhibited last October in the University Gallery at University of Newcastle, NSW Australia and the show will tour to the Maclaurin Galleries, Rozelle House in Ayr, Scotland in November 2011: http://www.south-ayrshire.gov.uk/galleries/maclaurin/exhibition.aspx

Digital processes and CAD technology is used routinely by most artists at some stage of the creative journey. It provides access to all kinds of output and display devices for making concepts visual or tangible that would have been unthinkable even thirty years ago. The students I teach have no difficulty in integrating digital making into their practice and take to new software like ducks to water. The question remains however, will there be a gender gap when it comes to integrating electronics and manipulating code? Will the next generation of women artists and designers be as equally proficient as the

men? How much of the knowledge gap is a lack of confidence, I wonder, from science and mathematics teaching in school and the lack of engagement with these subjects by girls.

I have recently interviewed several young artists about the use of technology in their work and have been surprised at the ways they are embracing collaboration. The role of the artist is changing from craftsman to creative director. It is no longer possible or practical in one lifetime, to develop expertise in every digital process or have a competency with the range of software necessary to access the plethora of digital tools and output devices available. It is much easier to collaborate with an expert at each stage of the process. The secret comes from understanding the processes required and being able to direct the creative vision for the artwork as it evolves. Artists who do want to remain working in a hands-on way tend to specialise in one particular piece of software and may only use a limited range of tools. For those of us willing to collaborate it is the social skills as well as the knowledge of processes that become important: how to be empathic and communicate effectively. This changing role may favour women who tend to communicate more easily and find social interaction less of a challenge than men.

In the redesign of the courses at the university art school where I teach, we are planning for this change. We will be offering courses that will stimulate creative collaboration and team working. Interdisciplinarity and awareness of what technologies can do will provide our up and coming creatives the knowledge to think innovatively and give them the practical skills for team working and co-design. I suspect we will need to integrate electronics and simple programming skills too and it will be interesting to discover whether the challenge to get involved in designing code will be embraced or resisted by the female students. Will there be a gender divide or has the world moved on?

I will continue to seek collaborators as I enjoy working this way. I love the creative buzz and the surprises that come from bouncing ideas off someone else and seeing what they make of my ideas. If you are a programmer or engineer and feel inspired to have a go at working with an artist in this way then have a look at my website and maybe get in touch: www.cathytreadaway.com

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Finding New Technology Opportunities in a Changing Economy for Women of a Certain Age

by Paula deWitte
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Women were among the first programmers and have contributed to the computer industry since the very beginning. There has never been the gender bias as with other older engineering disciplines although the number of women entering the computer science discipline is declining. Today, when many women reach a "certain age," they no longer find a computing career. What are their career paths? Mid-life career redefinition is the new economic reality and may help account for the declining numbers. This article discusses how women can leverage their computing and analytical skills to transition into new and rewarding career when they reach that mid-life, mid-career point. Opportunities include both traditional, logical choices such as becoming teachers or entrepreneurs as well as the less obvious choices. There are also many overlooked opportunities that build on a woman's experience and expertise in technology. This article does not provide a definitive list, but rather a framework for beginning to consider some of these career alternatives as well as how women must proceed in their mid-life redefinitions. The computing industry should address this issue and help mid-life women or risk losing significant experience and expertise from the young who pick alternative disciplines and from the older who no longer work in the field.

Jean Bartik, who passed away in April 2011, was a pioneering female computer programmer, whose work earned her the IEEE Pioneers Award and the Computer History Museum Fellows Award (Lohr, 2011). Ms. Bartik led the ENIAC programming team and worked with John Eckert and John Mauchly in the nascent field of computer programming. When Ms. Bartik lost her job in 1986 at the age of 61, she could no longer find employment in the computer industry and spent the rest of her life working as a real estate agent.

Ms. Bartik's experience of no longer finding work in a field she loved is not unique. Many mid-life women in computing find themselves in Ms. Bartik's shoes, wondering *"What's next?"* when a career ends, perhaps more suddenly than anticipated. There are obviously some exceptions. Most of the "women of a certain age" who continue to work in the computer industry are tenured university professors or high level corporate executives. But these success stories are overshadowed by the larger number of women over the age of 50 who are finding themselves forced out of an industry they still love.

From the beginning, the computing industry provided opportunities to women throughout the ranks — programmers, analysts, designers, and leaders. As a newer discipline, there was never the issue of whether women could be successful. Women, such as Ms. Bartik, were a part of the nascent computer discipline.

The computing industry openly attracts and solicits the young, many directly from college. Software engineering is ranked as one of the most sought after, better paying, and highly satisfying jobs. Almost any media depiction of programmers, including the front banner of the ACM-W website, is populated by young faces. There lies the conundrum. Building successful computer systems depends on understanding more than programming. Computer technologists must know the theory and application of algorithms and use analytical and communication skills. However, industry focuses on the programming skill, ignoring other skills that are independent of specific computer language, and prefers younger programmers.

Mid-life careers end for myriad reasons. There is the constant challenge to keep current technology skills. An old Doonesbury cartoon's punch line (Trudeau) predicated the bankruptcy of a successful software technology company because the entrepreneur had gone to lunch. Change is that fast. It's disruptive. The constantly challenging environment to learn and innovate draws us to technology. The challenge is a double-edged sword. Those in their twenties and thirties may not realize how difficult the constant retraining becomes until they reach their forties or fifties. It's not that mid-life women cannot learn new technologies or stay current, but rather we tend to develop a *"been there/done that"* response from the constant learning cycle new technologies and paradigm shifts brings.

My own career began with college classes where I used a slide rule for calculation and programmed mainframes. I long ago lost count of the number of computer languages I learned beginning with Fortran and Assembler, including PL/I (*Who remembers PL/I?*) and even a bit of "the last programming language ever needed" ADA, and ending when I last programmed my artificial intelligence based dissertation work on a LISP machine over twenty years ago. Do I think about returning to programming? Last year I purchased books intending to learn new programming languages. The books, the excellent '*Seven Languages in Seven Weeks*' (Tate, 2010) and books on PHP and web programming, sit on the book shelf in deference to my reading Steven Johnson's books such as '*Where Good Ideas Come From*' (Johnson, 2010) and researching privacy and security laws.

The constant technology change is not the only reason mid-life women find themselves without a clear career path. Some women left technical jobs to move into management positions that disappeared in this "Great Recession" and have no similar job options. Many lose their jobs quickly without time to plan for a smooth career transition. Other women, such as myself, burn out, finding themselves in a once successful career that no longer personally satisfies. It's a double-edged sword — the need to learn and innovate initially attracts us, but eventually leaves some without careers.

Some women decide to pursue other career dreams before it's too late. Regardless of the reason for being *unemployed*, *under-employed*, or *unhappily employed*, women, like men, of a certain age face the reality of being "too old." Anecdotally, I haven't met a single technical individual over 50 who lost his/her job in the Great Recession and was hired at a similar job. Beyond computing, I've met a mechanical engineer turned locksmith, a patent attorney who spends her time quilting, a software person who worked for the major 100-year computer corporation now works in a mall chain retail shop, and some recently laid off NASA shuttle engineers who believe they may never work in their fields again.

The stubborn, high unemployment rate is significantly higher for those over 50. The reality is that most individuals in their fifties plan to live another 30 productive years. With extended life spans, depleted retirement accounts, or concern about their long-term economic future, many Boomers want to continue working, either because they don't want to or can't afford to quit.

Many are women who broke through barriers to enter traditional male jobs and want to continue to work and contribute, but lack clear career direction for a discipline still loved. The salient observation is that there is a tremendous cost to society in terms of lost opportunities and economic value when these women's collective skills and knowledge are no longer used.

As Francis E. Allen, the first female Turing Award winner, noted that more women were entering the fields of cell biology, earth science, and medicine while the number of women in computer science continues to decline or in Ms. Allen's words "a national disaster" (Bair, 2008). It is possible that some women decline to enter the field because the chance for a lifetime career may be greatly improved with choosing sciences over computing.

Life lessons, if not wisdom, comes with age. There is a significant expertise, experience, and skill base that complements what is taught at the university. Programming paradigms change, however there is a constant body of knowledge gained through real world experience such as conducting research, generating business, managing projects, starting and running companies, managing employees, and interfacing with customers. No matter how outstanding universities are, they can't teach this real world experience. This is what society loses when experienced women turn their backs on the computer industry. I strongly believe that Ms. Bartik in her 60s still had much to offer the industry.

What happens to those of us with the philosophy to live like we're 50 until we're 80? (Crowley, Henry S. Lodge, & Sheehy, 2007) Or perhaps, to re-state the question: *Where does a mid-life woman look for new computing career opportunities?*

To explore that question, let me share my story. In my twenties I considered myself a hot-shot programmer. I'm not sure I ever considered what I'd be doing in another 25 years. My undergraduate degree is in mathematics, my first graduate degree in education, but after a few weeks of teaching high school, I knew that at the age of 23, a career change was imminent — my first of many. Lacking much formal computer education, I worked as an analyst/programmer first in the nuclear industry and then in a research group of Ph.D. structural engineers and statisticians. I learned enough about their work to support their system development and used that research experience as motivation to obtain a Ph.D. in Computer Science.

For the next 20 years, I led applied research and technology development teams and started and ran technology businesses, which I either owned or operated for investors. I conceptualized new research; wrote lots of proposals; obtained funding from government sources-the military, National Science Foundation, and Department of Homeland Security; made presentations; built teams; managed multi-year research projects; and became adept at crisis management — a necessary skill for any small business owner. Most of the technical nuts and bolts work was done by those I hired. I drifted away from my programming skills.

It was a great career although at some point, what had worked so well for so long became personally unsatisfying. I needed new mountains to climb. I'm not unique in the mid-life or mid-career redefinition. It is a phenomenon common to many women my age and not limited to those in technology.

Working in the Austin, Texas high tech community, I saw few people over 50 still working in the industry, Michael Dell being a notable exception. I did see attorneys who continued to practice well into their advanced years, and more importantly, I saw a lack of attorneys who had a technology or business owner background. The federal courts were enacting new Rules for Civil Procedures for electronic discovery or e-discovery (i.e., recovering any information stored electronically), and the legal industry encountered problems predictable to any good systems engineer. The vast majority of states were passing legislation defining business liability for identity theft, yet most attorneys didn't understand how data breaches could occur or what technical concepts such as 'encryption' meant or entailed. Cyber security was becoming more of a threat, both to corporations and national security, yet, the vast majority of attorneys lacked the requisite technical background to understand the enormity of the technical problem. I saw my next opportunity. After conducting my own due diligence and considering my career alternatives, I entered law school at the age of 53 with most students younger than my own adult children. I figured a law degree based upon my experience, expertise, and skillset would keep me working well into my seventies or until I decided to quit.

Once in law school, I joked that I was able to obtain both AARP and student discounts! I loved it! It was fun, a real life re-charging experience. There's something inherently satisfying about leaving the business suit in the closet, putting on jeans and a book bag, and heading back to some anonymity that school provides. I finished law school in a little over two years and successfully passed the Texas bar. I was published in the school's Law Journal, (Bill Piatt, 2009) the ABA Student Lawyer Magazine (deWitte, ABA Student Lawyer, 2009) about my experiences of studying law in a Russian summer program, and on the More Magazine website about my mid-life redefinition (deWitte, More Magazine). I was intellectually refreshed. As the speaker for those of us completing in the off-semester, I quoted the philosopher of my generation line as my last statement, *"Ah, but I was so much older then, I'm younger than that now"* (Dylan, 1964).

I was so ready for that new career! I was confident that I would find a job blending technology and the law. I never intended to focus on practicing law, but rather within a legal team or in legal services that required extensive technology knowledge. It has not worked exactly as I planned, but few things in life do. What I didn't plan was to re-enter the work force in the worst recession since the Great Depression and into the legal industry which generally disregards my experience before law school. I have had so many people remark that with my great resume, the world must be beating a path to my door. *Umm, not quite.*

Given that, I certainly do not regret my career and life change. My first year out of law school, I did what was suggested: leased an office, set up shop, and spent a lot of time networking. Recently, I gave up that executive suite office and began working in a collaborative workspace (Caroline Collective, 2011) in Houston that houses technology start-ups, artists and designers, and other professionals or small business owners. It's cheaper, much more fun, and attracts the most interesting people I've met in two years in Houston. I've greatly expanded my network, assisted drafting the licensing agreements for the video production (Aptekar Productions) for the Houston 2011 TEDx Conference (TEDx Houston 2011), and am enjoying more of the Houston art community from the collective exposure.

Paula working at Caroline Collective

The collaborative workspace has provided more potential clients, friends, and opportunities in a few months than anything I did the preceding year. And I enjoy a certain coolness factor with younger programmers when they learn I programmed in LISP for my dissertation work on natural language processing. In fact, I was hired by one engineering firm as their attorney when they learned I had programmed on a Symbolics LISP machine although it had absolutely nothing to do with their work. It gave me credibility. Who says programming doesn't pay off? (I leave out any references to any earlier COBOL programming experience so as not to diminish being cool.)

It occurs to me as somewhat ironic that I chose to place myself directly into a community that appeals to the young, the collaborative work environment, where I eavesdrop on web app developers. Along the way, I have come to realize that my dream job is to work in technology transfer or commercialization since I have unique experience in managing projects from concept through research and development and into fielded, profitable products in small companies. I know the agony of being a small business owner — being awake at 3 a.m. wondering how I'll make payroll or trying to license a product with a much larger, international company.

Until that job materializes (if it ever does), I'm consulting, started a solo law practice, and formed a joint venture for some technology-based products. The clients I enjoy the most are tech start-ups who are bootstrapping themselves into existence. These clients like me because I speak their language and have been in their shoes. I also write and lecture on security and privacy, volunteer to speak to women's technical groups, and continue to learn as much as I can. I plan to sit for the Patent Bar in a few months. I have expanded beyond technical writing to include fiction. When I catch up, I have a few ideas for some blog writing.

Based on my experience, I'd like to offer advice to those women who are mid-life and/or mid-career wondering *'What's next?'*

First, these career and life disruptions provide women with unique opportunities to redefine themselves. It's a step forward, not back, perhaps just not in a straight path. Many want to pursue their dreams before it is too late, and not end their lives like Tolstoy's character Ivan Ilyich, who on his death bed wonders if his whole life has been wrong. It becomes a very personal quest: *What career paths are open to me, and how do I make it happen?*

Second, women know that at the end of the day, it's up to them. We women juggle many roles — daughters, students, working wives, mothers, executives, and others depend on us. It's no surprise that we are ultimately responsible for making our own change happen, and this will be no different. Friends may be supporting, but the change depends on us, and it's hard. We must be proactive in creating new networks, learning new skills and technologies, and pursuing new opportunities. Notice the redundancy of the word '*new*'? A mid-career or mid-life redefinition is just that — *embrace the change and look for the new*. You may need to pursue Plans A, B, and possibly down to Z, especially in this wicked economy. I work out of a '*collaborative work environment*,' a concept I'd never previously known. I've changed how I seek out clients by attending coffee meet-ups targeted to entrepreneurs, entrepreneur bootcamps, or other activities that attract technology start-ups. For fun, I take classes — last fall I took a community education Russian course which has led me to meet-ups to practice Russian and discovering a Russian Cultural Center in Houston. For me, these types of activities keep my mind open to new ideas.

While in law school, my networks moved on, and when I finished, I focused on building new networks, *not rebuilding those I had*. After I took the Bar exam, I read a backlog of ACM and IEEE publications to see what happened during my Doonesbury two-and-a-half-year lunch. For example, the first time I saw the term '*fuzzy testing*' in cyber security, I wondered if it were a standard technology term or just the author's clever coining of a term.

Third, filter through advice — including this article — about redefinition. If you question that, go back to the preceding point. Many of my friends questioned my sanity in returning to school at my age. Frankly, I questioned my sanity. I already had three degrees and a ten-year investment in universities. I may never recover the financial investment of those lost productive years and law school expenses. *I went with my heart.* Twenty years ago, I would never have written that statement. I listened to and trusted that inner voice.

Fourth, don't be afraid to say, "I went with my heart." My career started in male-dominated environments at a time where women wore masculine, dark colored business suits to fit in. I still remember the only time I cried at work, and I still cringe at the memory. Women of my age learned to suck it up.

As technical women, we tend to live in our heads and take pride in our intellect. Mid-life and career changes are about listening to and using both our hearts and our heads. I continue to go with my heart. I haven't given up on my dream job, and I'll find it. In the meantime, my legal work and technical consulting keeps me busy and most engaged in meaningful endeavors within working relationships where I am constantly learning. What more can I ask for? There just aren't enough hours in the day.

Fifth, you're never too young to think and plan ahead. Time flies: Last winter you were reading an article in this newsletter about having babies while you're in graduate school (Alexandra Holloway, 2011) or during a challenging computing career, and seemingly it'll be tomorrow that you're discussing that very issue with your own adult daughter. None of us know what the next twenty years will bring in our work or career, but we can continue to add new skills, continue to build our networks that will help us transition into that phase of our life and career, if and when the time comes. This is consistent with Ms. Allen's advice about focusing on your work, and not your career. Careers and job titles will come and go. The real value is in the work that gives us the skills to carry us along.

Sixth, you're never too old to make changes happen. One of my favorite quotes by an 80-something Bikram yoga teacher, Emmy Cleaves, is '*Fear is what makes us old.*' Each of us faces fears. I faced fears walking into a first year law class. *What if I failed?* The old adage is that insanity is doing the same thing over and over again, expecting different results. We have to change, and doing so requires facing our fears.

With that context, let's consider some career choices for those women of a certain age. I've categorized them on scales of logical and obvious to the logical and less obvious.

Career Paths — the Logical and Obvious

The most logical career paths, or at least the most commonly suggested, for those transitioning out of computing jobs are to teach, volunteer, or run non-profits. Or rather, these choices used to be more logical, assuming one can find paid positions to teach or run non-profits. In this economy, all bets are off. Teach? Yes, and no. It's not a stretch for former techies to return to the high school classroom to teach high school mathematics or computer technology, depending on the particular programming languages taught. There may be a significant need although many states will not hire public school teachers who do not have proper academic credentials and certification. With budget cuts, I'm not sure such positions are open. I did consider a teaching adventure, perhaps teaching math on an Indian reservation.

It might be tougher to teach college level mathematics or computer science at the university level after so many years, and there aren't many openings that are not tenure-track positions (and looking for someone at the beginning of their career). What is overlooked are the other courses that experienced computing women could teach based on their work experience such as Entrepreneurship or Leadership or the other university positions such as working with start-up companies in incubators. I find a shortcoming of many universities is that they tend to hire, to their detriment, those with university backgrounds even in these non-traditional courses.

Career Paths — the Logical and Less Obvious

These are the career that most women would enjoy because they leverage their technology background. It might require a few steps backward but there is plenty of growth opportunity. An emerging job discipline is technology transfer or technology commercialization at both universities and industrial enterprises. Technology commercialization used to be an after-thought on research projects. Increasingly, enterprises incorporate technology transfer/commercialization into research and development to get research fielded faster and as a major revenue source. One must be able to quickly understand technology, particularly something outside of your direct expertise; communicate effectively between the technical and business worlds; evaluate and value intellectual property; pursue creative licensing or start-up opportunities; and facilitate programs to education on intellectual property protection.

Most current technology commercialization job posting prefer a life sciences background given the explosive growth of biosystems commercialization. However, I think other skills may be preferable than a specific academic background. When I programmed for a Ph.D. group of civil engineers and statisticians conducting fatigue analysis research of structures I was successful in spite of the fact that I lacked a civil engineering background. I've learned that if you love technology, it is not necessary to be an expert in that area. You must be able to quickly grasp concepts, build a business case, and understand the benefits. It's better to see the big picture rather than focus on the technology details.

Another open career path is to become a Patent Agent. Patent Agents write applications including the specification and claims for the U.S. Patent & Trademark Office (USPTO). Patent agents can do everything a Patent Attorney can do except appear in court. Many companies and law firms use patent agents for much of their work. The USPTO requires that potential agents have their Bachelors in specific technical scientific disciplines to take the Patent Bar. This work could be done on a part-time or contract basis and with telecommuting, allow a more flexible schedule. This may be an area where attention to a specialized technical area pays off.

Career Paths — the Risky

Many who have left the corporate computing world take the leap and start their own company. In fact, according to the Small Business Administration, women owners outnumber men by four to one. Further, the largest population of new entrepreneurs are Boomers — those over 50 — male and female. That is, a large number of mid-life women are starting businesses. The business can be a logical extension of a technical career or something completely different. Some consider it too risky, but for many, it's the only opportunity when shut out of the employment market which accounts for the large number of Boomer entrepreneurs.

It also represents a secondary, indirect entrepreneur opportunity by consulting with entrepreneurs to fill in business voids. I have found my technology start-up clients, while technically more astute than I, lack necessary experience that I uniquely provide: running a business, understanding long term cash flow, negotiating contracts, and protecting intellectual property — in general, understanding business.

While it takes a certain type of individuals to take the risk and start their businesses, it also gives one the freedom to define their businesses (and life as they want). I own my two businesses as a single owner and have just started joint development with another company for a specific product. I supply the product vision and marketing; they supply the programming talent. At this stage of my life, I do not want employees and to worry about bringing in enough work to carry everyone. I want businesses that I can operate while traveling anywhere in the world. As a result, I made the business decision to partner with other companies to develop my product ideas. These companies are excited for the opportunity and don't mind staffing up when projects are funded. For me, the loss of potential profit is more than offset by the freedom and control I enjoy. It's another one of those heart things.

Final Thoughts

If you're in your 20s and 30s, start thinking about career transition now. Discuss this with your friends and associates, male or female. Be open to new ideas and building skills that you may eventually need. One thirty-five year old engineer told me her ultimate career goal was to own an art gallery — twenty years or so from now.

If you're in the mid-life redefinition, find like-minded people, whether you're in mid-life redefinition or not. I think there are two types of Boomers: those you have redefined their lives and those that will redefine their lives. One of the most interesting groups of women I've discovered is The Transition Network (TTN) which has local groups in major cities. I attend in the Houston area where I've discovered women who are going through dramatic life changes — losing their corporate positions after long, dedicated careers and questioning if their sacrifices were worth it; becoming widowed; or losing their passion for their current job (as I did). An overwhelming number fear becoming a bag lady although this is probably unrealistic. Interestingly, many explore their creative side by becoming artists and writers. There is a tremendous group energy that has driven me to continue making my own life changes.

Don't take anything personally, but don't be a chump either. I was turned down for one job interview because I couldn't "get in" to big named law firm partners. The company was a high-tech legal e-discovery solution from the Silicon Valley looking to expand into other cities. I had read and knew the technical writings of all but one of the scientific board of advisors. In fact, I had taken courses from two. I could explain the technical problem they were solving, knew the Federal Rules of Civil Procedure and the case law, develop a business case for their technology, and explain why they had the best solution. That all failed to impress the HR Manager who wanted someone who could "get in." I failed to name a single partner at a large firm that convinced her I could do this job although that is no guarantee of an ability to explain why a law firm should be interested in this technology.

Another interview experience was with my Ph.D. graduate school where I had maintained contacts and had financially supported (note the past tense). After a seven month process and two interviews for the position of Assistant Vice-President, I received a short rejection e-mailed a few days before Christmas by a staff support person — *with my name wrong*. Yes, a small thing — and even an error Facebook makes — but still a thing. Seven months and neither the Vice-President for Research nor his Chief of Staff could take two minutes to write a "thanks for the interview." My "thank you" e-mails garned one response — five words back from the Chief of Staff's iPhone, "*Best of luck to you.*" I compare this with other experiences — even where I was not selected for an interview — and still received much more professional rejections.

On one hand, I could have overlooked the unprofessional slight. It may have been smart to keep those professional contacts. On the other hand, women in computing, young and old, have earned the right to be appreciated and respected professionally. *None of us have expended the amount of work — and for many of us, the blood, sweat, and tears of being the first women in the door — to be unappreciated or disrespected.* When necessary, we need to stand up and remind others of that. We owe it to ourselves. We owe it to those who come after us to demand professionalism for our chosen profession. And most importantly, we owe it to those women who came before us.

I hope Ms. Jean Bartik would have agreed.

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The Ohio Celebration of Women in Computing Inspires and Empowers

by Bettina Bair, bbair@cse.osu.edu

The Ohio Celebration of Women in Computing inspired, intrigued and informed 175 amazing women on February 18-19, 2011 at its fourth biennial conference held at the Mohican Resort in Perrysville, Ohio. Students and faculty from 26 universities and colleges, and industry representatives from 10 companies, traveled from as far as Texas to share their career paths and research, gain new knowledge and perspectives, and celebrate the different experiences they bring to the field of computing. In a field were women are underrepresented, OCWIC empowers women to see that they are the diversity that will create the next generation of technology.

OCWIC Participants

Featured speakers included: Sharon Nunes, Vice President of Big Green Innovations in IBM Systems & Technology Group; Maria Klawe, President, Harvey Mudd College and former Dean of the School of Engineering and Applied Science at Princeton; Casey Moran, Chief Technology Officer responsible for Client Services at General Electric; Jennifer Marsman, Microsoft Developer Evangelist; Joanne McGrath-Cohoon, Senior Research Scientist, National Center for Women & Information Technology; and Kimberly McLeod, Program Manager, Anita Borg Institute.

Other sessions included resume reviews, a career fair, panels on graduate school and industry careers, student poster contests (in which the winners received all-expense-paid scholarships to the national Grace Hopper Celebration of Women in Computing conference), and presentations and lightning talks given by graduate students and faculty on their research and outreach activities. Breakout sessions included Acing the Microsoft Interview, Crushing Gender Stereotypes, and College Life Balance. A new addition this year was a Recruiting Women into Your Computing Major workshop specifically for faculty.

OCWIC thanks its generous sponsors who made this conference possible. Industry sponsors included: (gold sponsors) General Electric, Microsoft Research, Cardinal Health, Anita Borg Institute; (silver sponsor) Eaton; and (bronze sponsors) AK Steel, and the Cleveland Clinic. University sponsors included: (gold sponsors) School of Engineering and Applied Science at Miami University, University of Dayton; (silver sponsors) The Ohio State University, Bowling Green State University, Franklin University, Computer Science and Software Engineering Department at Miami University; and (bronze sponsors) University of Akron, and Wright State University. If you would like to get involved with the Ohio Celebration of Women in Computing, we encourage you join in on the excitement by contacting us and getting on our mailing list.

The complete program, resources for participants, and contact information are available on the OCWIC website http://www.ocwic.org/. Keep checking that site over time for announcements about OCWIC 2013.

Dates & Deadlines

Three Regional Celebrations of Women in Computing Conferences are upcoming:

- MINKWIC http://minkcwic.acm.org is the first regional celebration of Women in Computing in the states of Missouri, Iowa, Nebraska, and Kansas. It takes place on October 7/8, 2011.
- The Computer Science Department at Tennessee Tech University is hosting the first regional conference of Tennessee Women in Computing (TNWIC http://www.csc.tntech.edu/tnwic/public/index.php) on October 14/15, 2011.
- The Ontario Celebration of Women in Computing (ONCWIC http://www.oncwic.ca) will take place on October 21/22, 2011 at the University of Toronto. For more information, contact Kelly Lyons (kelly.lyons@acm.org).

ACM Fellows and Senior Members Nominations

ACM Fellows http://awards.acm.org/html/fellow_nom_guide.cfm nominations are due September 6 and senior members http://awards.acm.org/html/amg_call.cfm#senior nominations are due on September 1, 2011.

ACM-W Travel Scholarship Applications for Students

ACM-W provides support for women undergraduates and graduate students who wish to attend research conferences. Deadline information is available at http://women.acm.org/participate/scholarship/index.cfm. Information about scholarship recipients and their conference experiences is available at http://women.acm.org/participate/scholarship/in_her_own_words.cfm#acmwscholars.

Contribute to the Next Issue of This Newsletter!

Please consider writing an article for the next edition of this newsletter! We are eager to create a great newsletter that captures Women in Computing issues at all educational and career stages. Interested authors should submit a brief (< 400 words) proposal/abstract here: http://tiny.cc/ACMWNewsletterProposal

Proposal deadline: November 10, 2011

After being notified of acceptance, authors will have approximately one month to submit the full (short [up to 2,000 words] or long [up to 5,000 words]) article using Google Docs.