Role Models and Champions — what we need to get more diversity in computer science

Jane Hillston

3rd December 2019

Outline

Outline

Early career aspirations

I wanted to be a writer!

Early career aspirations

I wanted to be a writer! I wanted to travel the world!

Early career aspirations

I wanted to be a writer! I wanted to travel the world!
I wasn't quite sure how to achieve this.

Early career aspirations

I wanted to be a writer! I wanted to travel the world!
I wasn't quite sure how to achieve this.

I was selected to represent Manchester at the London International Youth Science Fortnight in July 1981.

> *Founded in 1959, LIYSF aims to give a deeper insight into science and its applications for the benefit of all mankind and to develop a greater understanding between young people of all nations.*

Early career aspirations

I wanted to be a writer! I wanted to travel the world!
I wasn't quite sure how to achieve this.

I was selected to represent Manchester at the London International Youth Science Fortnight in July 1981.

> *Founded in 1959, LIYSF aims to give a deeper insight into science and its applications for the benefit of all mankind and to develop a greater understanding between young people of all nations.*

This literally changed my life as it made me much more focused on STEM (Science Technology Engineering and Mathematics).

My Career in Brief

My school encouraged me to pursue my best subject at University, which in my case was Mathematics.

- BA (Hons) in Mathematics at the University of York 1985

My Career in Brief

My school encouraged me to pursue my best subject at University, which in my case was Mathematics.

- BA (Hons) in Mathematics at the University of York 1985
  - About 35% female students but no female faculty.

My Career in Brief

My school encouraged me to pursue my best subject at University, which in my case was Mathematics.

- BA (Hons) in Mathematics at the University of York 1985
  - About 35% female students but no female faculty.
  - I was encouraged to stay for a PhD but was put off by the long term commitment and the lack of role models.

My Career in Brief

My school encouraged me to pursue my best subject at University, which in my case was Mathematics.

- BA (Hons) in Mathematics at the University of York 1985
  - About 35% female students but no female faculty.
  - I was encouraged to stay for a PhD but was put off by the long term commitment and the lack of role models.
  - I chose to travel instead....

My Career in Brief

My school encouraged me to pursue my best subject at University, which in my case was Mathematics.

- BA (Hons) in Mathematics at the University of York 1985
  - About 35% female students but no female faculty.
  - I was encouraged to stay for a PhD but was put off by the long term commitment and the lack of role models.
  - I chose to travel instead....
- MSc in Mathematics at Lehigh University, PA, USA 1986

My Career in Brief

My school encouraged me to pursue my best subject at University, which in my case was Mathematics.

- BA (Hons) in Mathematics at the University of York 1985
  - About 35% female students but no female faculty.
  - I was encouraged to stay for a PhD but was put off by the long term commitment and the lack of role models.
  - I chose to travel instead....
- MSc in Mathematics at Lehigh University, PA, USA 1986
  - About 20% female students, still no female faculty.

My Career in Brief

My school encouraged me to pursue my best subject at University, which in my case was Mathematics.

- BA (Hons) in Mathematics at the University of York 1985
  - About 35% female students but no female faculty.
  - I was encouraged to stay for a PhD but was put off by the long term commitment and the lack of role models.
  - I chose to travel instead....
- MSc in Mathematics at Lehigh University, PA, USA 1986
  - About 20% female students, still no female faculty.
  - I was encouraged to stay for a PhD but was put off by the long term commitment and the lack of role models.

My Career in Brief

My school encouraged me to pursue my best subject at University, which in my case was Mathematics.

- BA (Hons) in Mathematics at the University of York 1985
  - About 35% female students but no female faculty.
  - I was encouraged to stay for a PhD but was put off by the long term commitment and the lack of role models.
  - I chose to travel instead....
- MSc in Mathematics at Lehigh University, PA, USA 1986
  - About 20% female students, still no female faculty.
  - I was encouraged to stay for a PhD but was put off by the long term commitment and the lack of role models.
  - I saw a lot of the USA, visiting more than 20 states.

My Career in Brief

My school encouraged me to pursue my best subject at University, which in my case was Mathematics.

- BA (Hons) in Mathematics at the University of York 1985
  - About 35% female students but no female faculty.
  - I was encouraged to stay for a PhD but was put off by the long term commitment and the lack of role models.
  - I chose to travel instead....
- MSc in Mathematics at Lehigh University, PA, USA 1986
  - About 20% female students, still no female faculty.
  - I was encouraged to stay for a PhD but was put off by the long term commitment and the lack of role models.
  - I saw a lot of the USA, visiting more than 20 states.
  - I chose to go back to the UK and earn some money.

A brief dalliance with business

- Business Analyst in a financial software house in the City of London 1987-88
  - About 15% female colleagues, some in more senior roles – finally some role models!
  - I've never drunk so much champagne in my life!
    (This was the London City in the 1980s)
  - Fun while I was learning new skills, but ...
- Research Associate, Kingston Business School, Kingston-upon-Thames University 1988
  - Technology transfer project: developing an expert system for Unilever.
  - I realised that I much preferred the academic environment.
  - About 25% female colleagues and a female Head of Department.

And finally to Edinburgh....

- Research Associate and Part-Time PhD student, Department of Computer Science, University of Edinburgh
- Full-time PhD student, Department of Computer Science, University of Edinburgh
- EPSRC Post-doctoral Fellowship, Department of Computer Science, University of Edinburgh
- Lecturer, University of Edinburgh.....

PhD work — Performance Modelling

Performance is concerned with the dynamic behaviour of systems, particularly with respect to the resources within the system — performance degradation usually occurs when there is contention for resources.

PhD work — Performance Modelling

Performance is concerned with the dynamic behaviour of systems, particularly with respect to the resources within the system — performance degradation usually occurs when there is contention for resources.

Typical performance measures are

- Response time: the time from the user submitting a request until a response is received.
- Throughput: the number of completed tasks per unit time.
- Loss rate or blocking probability: the likelihood that a request for service is accepted by the system or not.

PhD work — Performance Modelling

Performance is concerned with the dynamic behaviour of systems, particularly with respect to the resources within the system — performance degradation usually occurs when there is contention for resources.

Typical performance measures are

- Response time: the time from the user submitting a request until a response is received.
- Throughput: the number of completed tasks per unit time.
- Loss rate or blocking probability: the likelihood that a request for service is accepted by the system or not.

Predicting these values involves building a mathematical model of the dynamics of the system, and evaluating it (or simulating it) to find the values of interest.

PhD work — Bringing Formality to Performance Modelling

Rather than building these mathematical models by hand, or in a general purpose programming language, my thesis developed an approach based on formal languages called process algebras.

PhD work — Bringing Formality to Performance Modelling

Rather than building these mathematical models by hand, or in a general purpose programming language, my thesis developed an approach based on formal languages called process algebras.

Process algebras had previously been used to build model which could verify the qualitative behaviour of a system, i.e., whether it behaved correctly.

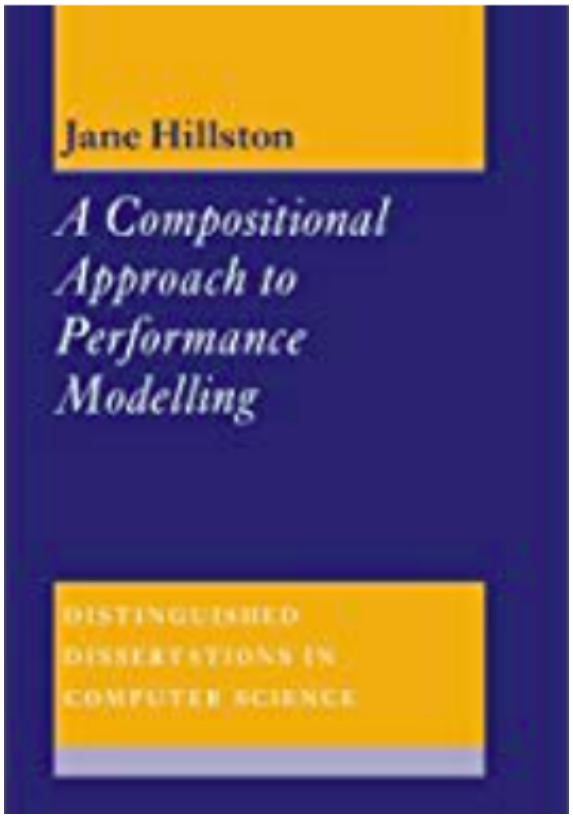
PhD work — Bringing Formality to Performance Modelling

Rather than building these mathematical models by hand, or in a general purpose programming language, my thesis developed an approach based on formal languages called process algebras.

Process algebras had previously been used to build model which could verify the qualitative behaviour of a system, i.e., whether it behaved correctly.

Extending process algebras to capture information about the timing and probabilities of actions in the system, allowed them to generate models which could be used to verify the quantitative behaviour of a system, i.e., whether it behaves correctly and in a timely way, with appropriate sharing of resources.

Bringing Formality to Performance Modelling



- My thesis was awarded a Distinguished Dissertation Award in 1995 by the British Computer Society and the Committee of Professors and Heads of Computing.

Post-doctoral fellowship — working with others

- I was awarded a two year postdoctoral fellowship, and for me, research became much more enjoyable when I worked in collaboration with others.

Broadening my horizons

For the first ten years after my PhD my research work stayed on similar topics to my thesis work because I had a number of other distractions:

- Teaching 1996 –
- Martha 1997 –
- Alice 2001 —

2005 Needham Award

- I was awarded the Needham Award in 2005. This is a UK Award given annually for a distinguished research contribution in computer science by a UK based researcher within 10 years of PhD.

2005 Needham Award

- I was awarded the Needham Award in 2005. This is a UK Award given annually for a distinguished research contribution in computer science by a UK based researcher within 10 years of PhD.

This was when I met Karen Spärck Jones.

Karen Spärck Jones FBA

- British computer scientist who was a pioneer of combining statistics and linguistics for natural language processing.
- Her work on inverse document frequency underpins most modern search engines.
- Advocate for women in the field.
- In 2007, shortly before she passed away she was awarded the Lovelace Medal – still the only woman (since 1998).

Karen Spärck Jones FBA

- British computer scientist who was a pioneer of combining statistics and linguistics for natural language processing.
- Her work on inverse document frequency underpins most modern search engines.
- Advocate for women in the field.
- In 2007, shortly before she passed away she was awarded the Lovelace Medal – still the only woman (since 1998).

"Computing is too important to be left to men!"

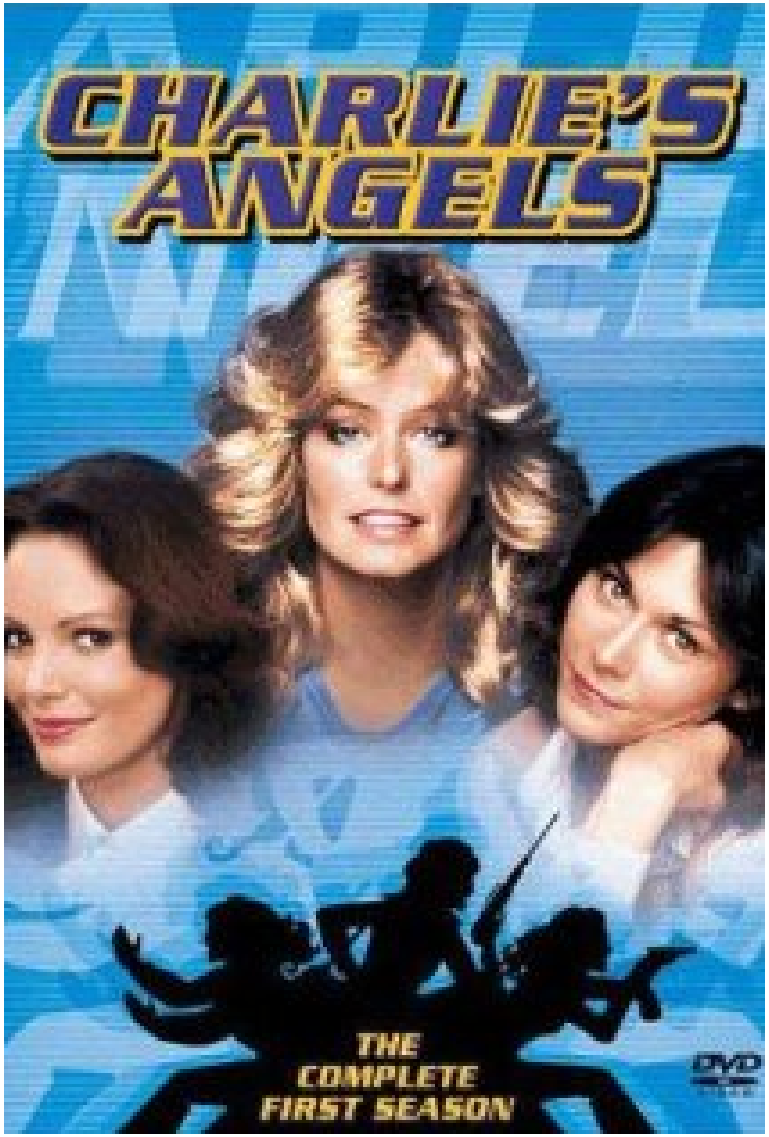
She also said:

"I certainly think that professionalism is very important....To be a proper professional you need to think about the context and motivation and justifications of what you're doing...You don't need a fundamental philosophical discussion every time you put finger to keyboard, but as computing is spreading so far into people's lives you need to think about these things....I've always felt that once you see how important computing is for life you can't just leave it as a blank box and assume that somebody reasonably competent and relatively benign will do something right with it."

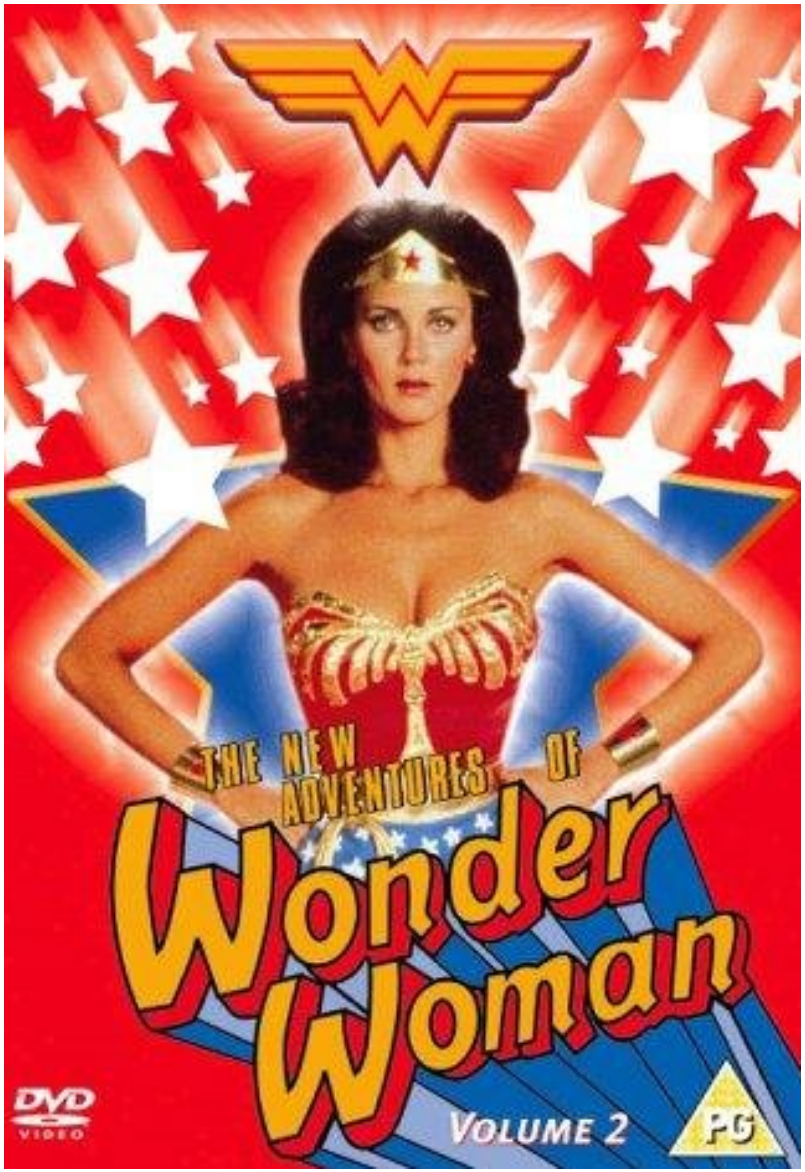
`https://www.bcs.org/content-hub/computings-too-important-to-be-left-to-men/`

Outline

Female Role Models in the 1970s...



Female Role Models in the 1970s...



Female Role Models in the 1970s...

Female Role Models in the 1970s...

Female Role Models in the 1970s...

Female Role Models in the 1970s...

Female Role Models in the 1970s...

Female Role Models Closer to Home

Fallowfield High School for Girls 1975 - 1982

Female Role Models Closer to Home

My mother was a scientist, working in a textile research lab and later in an operational research company.

Role Models during my career

My Role Models: Wendy Hall DBE FREng FRS

- First female British computer scientist elected to the Royal Society (2009).
- First female President of the British Computer Society.
- First female President of the ACM
- Dame of the British Empire (national treasure).

My Role Models: Marta Kwiatkowska FRS MAE

- Second woman computer scientist to be elected to the Royal Society (2019)
- Her work on modelling and verification probabilistic systems has won many prizes.
- The software tool implementing many of her results, PRISM, is used worldwide.
- She will be awarded the Lovelace Medal in 2020 – only the second woman (since 1998).

My Role Models: Muffy Calder OBE FREng FRSE

- Scottish/Canadian computer scientist working in formal methods and verification.
- Currently Vice-Principal and Head of College of Science and Engineering at Glasgow University.
- Was previously Head of School of Computing at Glasgow.
- From 2012-2015 she was Chief Scientific Advisor to the Scottish Government.

My Role Models: Ursula Martin CBE FREng FRSE

- Was previously Vice-Principal of Science and Engineering at Queen Mary, University of London.
- Research spanning many areas of theoretical computer science.
- Advocate for women in computing and mathematics.
- Recently co-authored a highly acclaimed book about Ada Lovelace.

My Role Models: Lesley Yellowlees CBE FRSE FRSC

- Former Vice Principal and Head of College of Science and Engineering at the University of Edinburgh.
- First female President of the Royal Society of Chemistry (2012-14).
- Internationally recognised researcher in electro-chemistry.
- Led the "Tapping all our talents" review of the Royal Society of Edinburgh in 2018.

Outline

A General Champion: Wendy Hall DBE FREng FRS

- Through her positions of influence Wendy Hall has promoted the careers of many other women.
- Always reminding others to "think woman" when filling opportunities for panel memberships, editorships, speakers etc.
- Personally mentoring many women to ensure they have the confidence to take up these opportunities.

A Gender Champion: Tom Welton OBE FRSC

- Commissioned the "Breaking the Barriers" report and champions inclusivity and diversity within Chemistry in both academia and industry.
- President Elect for the Royal Society of Chemistry.

Personal Champion: Gordon Plotkin FRS FRSE MAE

- Internationally leading theoretical computer scientist.
- Senior colleague who at key points in my career has offered support and encouragement, most crucially when my children were young.

Community Champion: Athena SWAN

- The Athena SWAN Charter evolved from the Athena Project and the Scientific Women's Academic Network (SWAN), to advance the representation of women in science, engineering and technology.
- It grants awards to higher education institutions, and departments within them, that can demonstrate that they are taking action to address its principles.
- It was launched in 2005 and the first awards were granted in 2006.

Athena SWAN Principles

- To address gender inequalities requires commitment and action from everyone, at all levels of the organisation;
- To tackle the unequal representation of women in science requires changing cultures and attitudes across the organisation;
- The absence of diversity at management and policy-making levels has broad implications which the organisation will examine;
- The high loss rate of women in science is an urgent concern which the organisation will address;
- The system of short-term contracts has particularly negative consequences for the retention and progression of women in science, which the organisation recognises;
- There are both personal and structural obstacles to women making the transition from PhD into a sustainable academic career in science, which require the active consideration of the organisation.

Changes post-May 2015

In May 2015 the Athena SWAN was expanded in a number of changes, which can be roughly summarised as:

- not just about one gender;
- not just about academics;
- not just about the sciences;
- more complete data analysis (intersectionality at institutional level).

Athena SWAN New Principles

The 10 new principles address the same points as the original principles but with a slightly different tone. In addition there are now explicit commitments with respect to:

- closing the gender pay gap,
- tackling the discriminatory treatment often experienced by trans people.
- acknowledging that advancing gender equality demands commitment and action from all levels of the organisation and in particular active leadership from those in senior roles.
- mainstreaming sustainable structural and cultural changes — supporting individuals alone will not sufficiently advance equality.
- recognising that individuals have identities shaped by several different factors.

Athena SWAN Awards

There are three levels of award:

- Bronze: identified particular challenges and planned activities for the future.
- Silver: significant record of activity and achievement and can demonstrate impact of implemented activities.
- Gold: significant, sustained progression and achievement, beacons of achievement that champion and promote good practice and Athena SWAN.

The School of Informatics at Edinburgh successfully applied for a Silver award in April 2013 — only the second Computer Science department to gain such an award.

Me as a champion...

I now try to give back, encouraging greater gender equality in the discipline and more broadly:

- Member of the University's self-assessment team for the recent successful application for an Athena SWAN Institutional Silver award.
- Led the School's first Athena SWAN Silver award in 2013, and assisted in the renewal in 2016, assisting in our application for renewal in 2020.
- Member of the Women's Committee of the British Computer Science Computing Academy.
- Member/Chair of the Women in Informatics Research and Education (WIRE) working group of Informatics Europe.
- Previous member of ACM-WE, the ACM Europe's committee supporting the role of women within Computing.

Suffrage Science Award

I was proud to be the recipient of a Suffrage Science Award for Computer Science in October 2018. These awards, sponsored by L'Oreal and the Medical Research Council are granted to women who are recognised for their technical contribution in addition to their work for encouraging more women into the discipline.

Women in Computing in Edinburgh

- When I came to Edinburgh to join the Department of Computer Science (before the School of Informatics was formed) there was one woman on the faculty (Rosemary Candlin).

Women in Computing in Edinburgh

- When I came to Edinburgh to join the Department of Computer Science (before the School of Informatics was formed) there was one woman on the faculty (Rosemary Candlin).
- She retired at the same time as I joined the faculty, so there was still only one woman on the faculty...

Women in Computing in Edinburgh

- When I came to Edinburgh to join the Department of Computer Science (before the School of Informatics was formed) there was one woman on the faculty (Rosemary Candlin).
- She retired at the same time as I joined the faculty, so there was still only one woman on the faculty...
- But things have improved considerably over the years, particularly since the formation of Informatics.

Women in Computing in Edinburgh

- When I came to Edinburgh to join the Department of Computer Science (before the School of Informatics was formed) there was one woman on the faculty (Rosemary Candlin).
- She retired at the same time as I joined the faculty, so there was still only one woman on the faculty...
- But things have improved considerably over the years, particularly since the formation of Informatics.
- We now have one of the highest percentages of female undergraduates in Computer Science in the country — 27% in the current UG cohort compared with a national average of 16%. Over 20% of our Full Professors are female and we have had two successive female Heads of School.

Widening the pipeline

- Unlike many science, Informatics does not suffer from a "leaky pipeline" so much as a **narrow** one.

Widening the pipeline

- Unlike many science, Informatics does not suffer from a "leaky pipeline" so much as a **narrow** one.
- There are many wonderful role models and counterexamples to any claim that women can't do/won't enjoy/... Computer Science.

Widening the pipeline

- Unlike many science, Informatics does not suffer from a "leaky pipeline" so much as a **narrow** one.
- There are many wonderful role models and counterexamples to any claim that women can't do/won't enjoy/... Computer Science.
- We need to disseminate that message more widely.

Outline

Conclusions

As Karen Spärck Jones said "Computing is too important to be left to men" ....

Conclusions

As Karen Spärck Jones said "Computing is too important to be left to men" ....

..... but equally addressing the gender inequality problem in computing is too big a job to be borne only by the women

Conclusions

As Karen Spärck Jones said "Computing is too important to be left to men" ....

..... but equally addressing the gender inequality problem in computing is too big a job to be borne only by the women

We must all work together for a new ethos in the discipline that welcomes and respects a representative diversity, ensuring that the systems that we build are suitable for all.