

2017
WHITE PAPER

Ada Lovelace

CHAMPIONING SUCCESS

And: *Avoiding the echo chamber.*

SOLUTIONS AND RECOMMENDATIONS.

HOW TO
be an ally

DIVERSE

there's still
work to do.

Championing the Success of Women in Science, Technology, Engineering, Maths, and Medicine

A collection of thought pieces from members of the academic community

#ChampioningWISreport

OCTOBER 2017



DIGITAL
science

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"We need to gather and share our success stories, to show the world that times are indeed changing, and that equality is achievable"

Foreword

Suw Charman-Anderson

The reason that you're reading this report is that something rare has happened over the last year. In 2016, when Lauren Kane and Alice Meadows wrote [Party at the Podium](#)¹ – their call to arms over gender equality – I'm sure that they expected many murmurs of agreement, followed by a deathly silence. That's been the common pattern over the years: a rousing speech, cheers and then... nothing.

This time, though, something did happen. Both men and women stepped up to the plate, making changes in their own lives, in their companies' policies, and in the gender balance of their conferences. But it was more than just that. What was unusual was that people actually told Kane and Meadows about what they'd done.

As someone who has been advocating for women in science, technology, engineering and maths (STEM) for nearly a decade as the founder of [Ada Lovelace Day](#)², I can promise you that such feedback is both unusual and necessary. Because when we talk about solving the problems faced by women in STEM, what we're really doing is asking both men and women to rethink their assumptions about the roles women can and do play in STEM, and in society more widely. We are asking them to modify their habits, both in thought and action, asking them to create new, fairer systems and processes, and to adjust their expectations around who does what. We are asking people to create a permanent cultural change, and that's a big challenge.

Cultural change is hard, slow, and often tedious. It takes a plurality of approaches from a wide variety of people, some of whom take high-profile roles as rainmakers, but most of whom are working tirelessly behind the scenes on what appear to be quite small and mundane changes. These silent change-makers have a powerful positive effect on people's lives and careers: the lecturer making sure that their female students are supported and encouraged, the CEO making sure that recruitment practices account for unconscious bias, the student creating a network for women in STEM. These people are all vital to creating widespread change, though they rarely hit the headlines.

For small, grassroots organisations like Ada Lovelace Day, and many other similar groups around the world, it is incredibly hard to measure the impact of our work. For individuals, it's functionally impossible.

This is why it is so heartening to find out that Kane and Meadows' post did get results, that people did take action. It is not often that advocates get any feedback at all about our work, so it is important to collect and share these stories. Indeed, I encourage everyone to 'report back' to the organisations, people and events organisers who have inspired them to do something, no matter how small. For it is the small actions, in aggregate, that create big and lasting change.

In this report, Tracey Armstrong suggests that if we increase the number of women with fiscal power in key positions of responsibility,

we can accelerate the pace of that change. As she says, “in academic publishing, women make up 63 per cent of the workforce, but only 44 per cent of management.”

This is a trend we see across STEM, even in areas such as biology or medicine, which are often seen as triumphs for equality because of the high number of women at undergraduate level. But whilst [65 per cent of early-career researchers in the biomedical sciences are women](#)³, they account for less than 20 per cent of biomedical research professorships.

Women should not be afraid to seek power, and that means seeking to control budgets and becoming responsible for staff. “Women need explicit and implicit power to grow in their careers,” says Armstrong, “and revenue and power are closely aligned”.

When we look at the history of social change, it’s clearly a nonlinear process. In 2015, Bloomberg [visualised the pace of social change in America](#)⁴, comparing the speed with which states legalised interracial marriage, women’s suffrage, abortion, same-sex marriage and recreational marijuana. It is clear that the evolution of attitudes follows a ‘tipping point’ model, that once a sufficient number of people believe that change is required, that change happens rapidly.

Women were only granted full suffrage in the UK in 1928, a mere 89 years ago. And as late as the 1970s, women were often refused mortgages because so few were in full time employment. It can be easy to forget how much progress we have made, and it is impossible to know how close we are to that tipping point.

The fundamentals of our call to action remain the same: we need people to keep on making changes, however small, to level the playing field for women and all other minorities in STEM. But I’d like to add a corollary: we also need to tell those who advocate, those who organise, those who give us a helping hand, when they have been successful. We need to gather and share our success stories, not just to show ourselves that we’re having an impact, but to show the world that times are indeed changing, and that equality is achievable.

Suw Charman-Anderson is the founder of Ada Lovelace Day, an international celebration of the achievements of women in science, technology, engineering and maths. Each year, ALD hosts a flagship science cabaret event in London, whilst around the world independent groups put on their own events. The organisation also works all year round to raise the profile of and support women in STEM, producing a podcast, resources database, free education pack for teachers, posters and women in STEM crochet patterns.

Prior to working full-time on Ada Lovelace Day, Suw was a social technologist and, as one of the UK’s social media pioneers, worked with clients worldwide. A freelance journalist, she has written for The Guardian, CIO Magazine and Forbes.

In 2005, Suw co-founded the Open Rights Group, a digital rights campaigning group. As its first Executive Director, she prepared the organisation’s response to the Gowers Review of Intellectual Property, and gave evidence on digital rights management to the All Party Parliamentary Internet Group.

1. *Parity at the Podium: Why We Need More Women Speakers, Digital Science*
<https://www.digital-science.com/blog/perspectives/parity-podium-need-women-speakers-stmchallenges/>
2. *Ada Lovelace Day*
<https://findingada.com/>
3. *Putting the spotlight on women in science*
<https://www.kidneyresearchuk.org/news/putting-the-spotlight-on-women-in-science>
4. *This Is How Fast America Changes Its Mind*
<https://www.bloomberg.com/graphics/2015-pace-of-social-change/>



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What a Difference a Year Makes: Parity at the Podium Revisited

Lauren Kane and Alice Meadows

It's been over a year since Digital Science published our post on [Parity at the Podium](#)¹ – a look at the gender imbalance among speakers at industry conferences, based on a study featured in [Learned Publishing](#)² (author accepted version available on [Figshare](#)³). So, when they invited us to contribute a piece in honour of Ada Lovelace Day it seemed like the perfect opportunity to revisit that study. Was it worthwhile? Did our recommendations – to women, their organisations, and our industry organisations – have an impact? If so, what other practical steps can we take as a community to address the gender gap – and the broader issue of diversity in scholarly communications? While the answers to these questions are at least partly anecdotal, we are pleased to see that some progress is being made.

Our challenge to individuals was for women “to take responsibility for accepting opportunities as they arise” – and of course, this advice applies to everyone, not just women. At the personal level, we are happy to have been contacted by numerous individuals who have responded to our challenge in a variety of inspiring ways. A mid-career woman who usually turns down speaking opportunities decided to accept one (and, despite her nerves, thoroughly enjoyed herself!). A senior man noted that he will no longer accept speaking invitations if there isn't at least one woman on the panel. And an early-career woman relayed a story of believing in herself, applying for a “reach” job she didn't think she was qualified for, and getting it because, in fact, she was.

In addition, it's been great to see other individuals take up the “Mind the Gap” theme and, in many cases, broaden the discussion to include other forms of diversity. In the US, at this year's Society for Scholarly Publishing meeting, Rebecca McLeod led a panel on [Toward a Diverse Workforce in Scholarly Publishing](#)⁴, while at the Council of Science Editors meeting, Ken Heideman of the American Meteorological Society moderated a session entitled: [Mind The Gap II: Gender and Beyond](#)⁵. In the UK, Charlie Rapple moderated a session at UKSG entitled Mind the Gap: Taking Action to Diversify our Workforce.

On the organisational front, our recommendation was to not let history determine future speaking candidates. We urged organisations to “provide and encourage – for the benefit of both genders – training on public speaking that levels the playing field and improves [the] pool of potential speakers.”

Although we don't have specific examples of publishers providing this kind of training, we do know of a number of excellent examples of companies that are actively working on improving their leadership diversity. Elsevier and Emerald Publishing are just two cases of companies that have not only challenged themselves to be better, but have provided paths for others to emulate them by publicly sharing their progress.

At the Society for Scholarly Publishing (SSP) 2016 annual meeting in Vancouver, we organised a [Mind the Gap](#)⁶ panel that included Nigel Clear of Elsevier, who talked about the company's efforts to ensure more diversity among speakers at their own events. At the same time, Elsevier was working with [EDGE \(Economic Dividends for Gender Equality\)](#)⁷ to benchmark and improve gender parity within the company. The EDGE certification requires "a rigorous and comprehensive assessment of five key areas: recruitment and promotion, leadership development training and mentoring, equal pay, flexible working, and company culture."

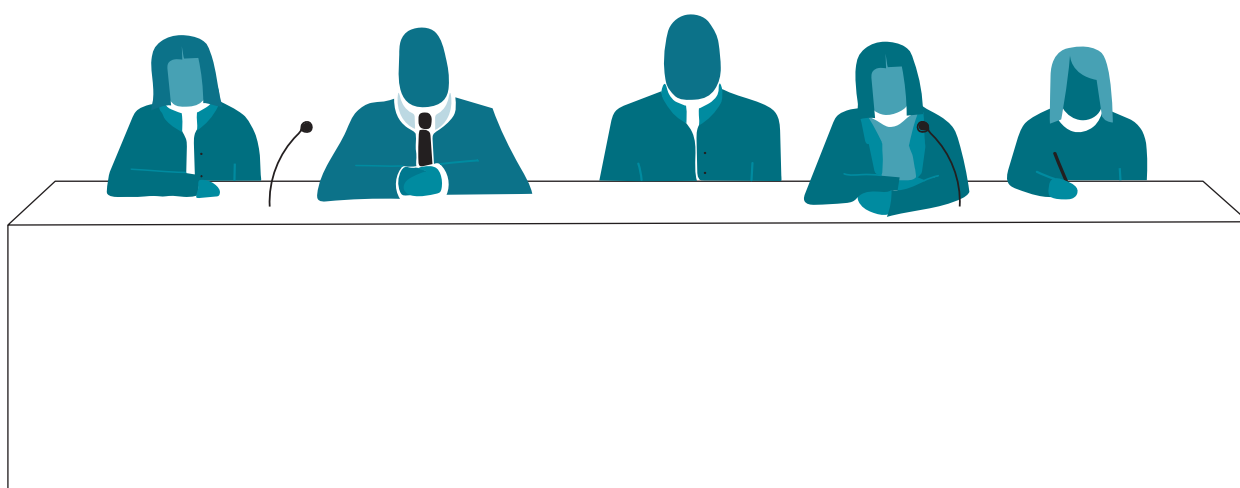
Emerald Publishing's efforts to improve gender disparity led them to introduce a program called STRIDE. However, following an employee review in November 2016 the company decided to focus on the broader theme of Thinking Beyond the Stereotype in 2017 – celebrating all forms of diversity, regardless of gender. The STRIDE committee includes men and women from all areas of the organisation, including its key regional hubs: Latin America, North America and Eastern Europe. Vicky Williams, Group HR Director, notes that, with STRIDE, they were: "responding to what we saw as an opportunity rather than a challenge, and have seen both tangible and intangible benefits as a result – from increased female representation in our leadership team, to a positive recruitment tool."

There's also cause for celebration at the industry level, where our challenge was to develop an accreditation system that publicly recognised organisations that prioritised diversity. This method was chosen as a way to acknowledge "those organisations that are contributing to progress" including providing "a 'seal of approval' on industry conferences that adhere to certain standards."



Alice Meadows is the Director of Community Engagement and Support at ORCID, responsible for bringing together the why (communications and marketing for ORCID) with the what and the how (technical support) through community engagement and outreach activities. Previously, Alice held a variety of marketing and communications roles in scholarly publishing. She also serves on the SSP Board of Directors and, with Lauren, co-chairs SSP's 40th Anniversary Task Force. Alice is a regular contributor to The Scholarly Kitchen and other blogs and publications, and received the 2016 ALPSP award for contribution to scholarly publishing. She has a BSc with Honors in Anthropology from University College London.

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"We are delighted to report that there has been a noticeable overall increase in the number of women speakers at industry conferences over the past year"

Although any form of accreditation is a long way off, we are delighted to report that there has been a noticeable overall increase in the number of women speakers at industry conferences over the past year. Looking at the same seven conferences that we covered in our original analysis, the average representation among these conferences has increased from 37 per cent female speakers in 2015 to 48 per cent in the past 12 months (June 2016-May 2017).

Specifically:

- Academic Publishing in Europe (APE) increased from 17 per cent to 41 per cent women speakers
- Professional & Scholarly Publishing (PSP) increased from 24 per cent to 36 per cent (disappointingly, the popular "The Innovators" session was an all male panel, despite there being many women who have founded startups that might have been included)
- Open Access Scholarly Publishers Association (OASPA) increased from 26 per cent to 68 per cent
- Association of Learned Professional and Society Publishers (ALPSP) increased from 36 per cent to 50 per cent
- International Association of Science, Technical and Medical Publishers (STM), SSP, and Association of American University Presses (AAUP) all dropped slightly (from 45-40 per cent 55-46 per cent and 58-54 per cent respectively). We know, however, that all three organisations are proactively encouraging speaker diversity.

APE is an interesting example. Historically a very male-dominated conference in terms of speakers and attendees, in 2017 the number of women speakers increased significantly, and there was also a session on diversity entitled [Room at the Top - It's Good for Business](#)⁸.

APE organiser and Chairman, Arnoud de Kemp told us: "Since 2006 we organise the annual international conference, Academic Publishing in Europe – APE – in the Academy of Sciences in Berlin (Germany). The program is composed with the help of some very active colleagues. Each year we got a lot of praise for the program, but also some comments about the large number of male speakers. I was inspired by an article by Lauren Kane and Alice Meadows in Learned Publishing to work harder on a better representation of female speakers. For the 2017 Program I had great support from Liz Marchant, Liz Ferguson, Eefke Smit and others (not to forget Bob Campbell) to improve the situation and we indeed managed to present a very balanced program. We will continue these efforts for the APE 2018 Conference on 16-17 January 2018 in Berlin."

So, what's next? We are delighted to report that there are likely to be more developments soon at the industry level. SSP hosted a meeting of industry organisation leaders to discuss the challenge of diversity in scholarly communications at its 2017 annual meeting in Boston, to see if there was any interest in collaborating to address the issues at hand. SSP Executive Director, Melanie Dolechek reports that: "Leaders from a number of societies and associations representing scholarly communications professionals enthusiastically came together at the SSP Annual Meeting in June to discuss the topic of diversity and how they might collaborate to increase awareness, provide tools and resources for their collective memberships and recruit a more diverse pool of candidates for employment. The group will be meeting again over the summer to continue the conversation and define next steps." You can read more about the initiative in [this post](#)⁹ by ALPSP Executive Director, Audrey McCulloch.

And let's not forget about the next steps we can all make! What better way to celebrate Ada Lovelace Day than by committing ourselves to remain engaged with diversity at a personal level, and by encouraging our organisations to commit to addressing it? Whether you're an individual planning your own career development, a manager thinking about hiring or promotion opportunities, or a CEO working on Board recruitment, diversity – in all its shapes and forms – can and should be front and centre of our considerations. After all, the community we serve is diverse and we will serve it better if we embrace that diversity at all levels.

1. *Parity at the Podium: Why We Need More Women Speakers, Digital Science*
<https://www.digital-science.com/blog/perspectives/parity-podium-need-women-speakers-stmchallenges/>
2. *From the podium to the boardroom: Encouraging gender parity in scholarly publishing*
<http://onlinelibrary.wiley.com/doi/10.1002/leap.1022/ful>
3. *From the Podium to the Boardroom: Encouraging Gender Parity in Scholarly Publishing*
https://figshare.com/articles/From_the_Podium_to_the_Boardroom_Encouraging_Gender_Parity_in_Scholarly_Publishing/3114178
4. *Concurrent 2E: Toward a Diverse Workforce in Scholarly Publishing...*
<https://www.sspnet.org/events/annual-meeting-2017/2017-schedule/concurrent-2e/>
5. *Mind The Gap II: Gender and Beyond*
https://www.resourcenter.net/Scripts/4Disapi07.dll/4DCGI/events/eventdetail.html?Action=Events_Detail&&InvID_W=23673
6. *Concurrent 5E: Mind the Gap 2...*
<https://www.sspnet.org/events/past-events/annual-meeting-2016/2016-schedule/concurrent-5e-mind-the-gap-2/>
7. *Economic Dividends for Gender Equality*
<http://www.edge-cert.org/>
8. *Room at the Top – It's Good for Business*
<http://zeeba.tv/room-at-the-top-%E2%80%93-it%E2%80%99s-good-for-business/>
9. *More that unites us? Research Information*
<https://www.researchinformation.info/news/analysis-opinion/more-unites-us>



Tracey L. Armstrong is the President and Chief Executive Officer at Copyright Clearance Center, bringing more than 20 years of experience in rights management with CCC to the industry. Leading the organisation through a period of phenomenal change and challenge, Tracey has helped transform CCC's licensing solutions to meet the needs of today's digital publishing world. Tracey works with publishers, authors, universities, businesses and industry associations around the world, addressing copyright concerns and establishing new alliances. In addition, she frequently speaks at industry conferences and events as a thought leader on digital copyright licensing issues. Tracey holds an MBA from Northeastern University and serves on the Board of the International Federation of Reproduction Rights Organisations (IFRRO).

To Accelerate Pace of Change, Women Need to Own Revenue

Tracey Armstrong

Women need the opportunity to experience controlling budgets and being responsible for revenue. I am the President and CEO of Copyright Clearance Center (CCC), a global licensing and content solutions organisation and the leading commercial document delivery provider. I had the opportunity to own my first revenue line in my 20s giving me the experience I needed to become a more effective leader now. In my time as CEO, CCC's revenue has grown over \$190M. Women who came before me in this industry carved a path which I was fortunate enough to walk on, and it is my responsibility to broaden that path for the next generation of women coming up in the industry. If more women move into positions with responsibility for revenue, I believe we can accelerate the pace of change.

In academic publishing, women make up 63 per cent of the workforce and men 36 per cent according to Digital Science and Fordham University Business School's [2015 Scholarly Publishing Demographic survey](#)¹. Yet while women often move into editorial, production and marketing roles, men are more apt to head for revenue-generating, attention-getting positions in technology (24 per cent vs. 12 per cent women), new ventures (25 per cent vs. 18 per cent women), and management (50 per cent, vs. 44 per cent women). Change can surely be effected more rapidly with more women moving into these male dominated areas.

So how can more women advance?

- 1. Move into positions where you can own revenue.** It's common sense: women need explicit and implicit power to grow in their careers, and revenue and power are closely aligned. Positions with P&L responsibility, sales, and business development are great places to launch to the next level. For leaders looking for diversity: you are already surrounded by women and men who will compose the majority of your organisation's future leadership.
- 2. Don't make excuses for living your life.** Although not true in all cases, a woman might say, "Oh, I'm sorry! I have to duck out of the office to pick up my kid, so I'll be late to the meeting." A man, on the other hand, is more likely to put it this way: "I'm tied up until 10am, so I'll see you at the meeting when I get there." In other words, men can be less likely to make excuses when they have outside commitments. It has been said that men are like Teflon; nothing

sticks to them. Women are more like Velcro, taking on the burdens of others and inadvertently setting themselves back. Don't be Velcro.

3. Get a mentor - and be one.

Mentoring happens in different ways; it doesn't have to be a long, drawn-out, time-intensive relationship. You can get or give an enormous amount of value from having one lunch with a colleague. That's really all it takes. I believe it's up to both men and women to mentor and, in fact, my first mentor at CCC was former CEO, Joe Alen. So look around and identify who might benefit from your experience, and who might help guide you – and as mentioned above, look for mentors who own revenue.



Even in progressive states like Massachusetts, headquarters of CCC, the gap between men and women in the corner office remains sizable: a [study released in March 2017](#)² by Nichols College's Institute for Women in Leadership found that in Massachusetts, women represent just 5.3 per cent, 18.6 per cent and 12 per cent, respectively, of corporate CEOs, board members, and executive officers.

"I believe it's up to both men and women to mentor"

Women can take the helm of an organisation – and they should. Nichols College President Susan West Engelkemeyer reflected in the study's introduction, "Diversity in the workplace is a distinctly identified competitive advantage."

Diversifying leadership in academic and scholarly publishing is critical to the future success of our industry. To innovate, we need to infuse the industry with new leaders, new ideas, new technologies and new directions. Our industry needs to attract the talent of tomorrow. Companies who can attract young men and women are organisations that will successfully create business models to cater to the future needs of scientists and researchers. When emerging graduates and academic talent look to the job market, they will expect their new employer to look like their campus – populated with prominent men and women – and publishing companies with diverse leadership will have a competitive advantage in talent acquisition.

"Look for mentors who own revenue"

1. [Scholarly Publishing Demographic Survey Reveals Major Diversity Challenges in Scholarly Publishing](https://www.digital-science.com/blog/news/scholarly-publishing-demographic-survey-reveals-major-diversity-challenges-in-scholarly-publishing-challengestm/)
<https://www.digital-science.com/blog/news/scholarly-publishing-demographic-survey-reveals-major-diversity-challenges-in-scholarly-publishing-challengestm/>
2. [Massachusetts Women's Leadership Index](http://iwl.nichols.edu/wp-content/uploads/2017/03/Massachusetts-Womens-Leadership-Index-2017-Web.pdf)
<http://iwl.nichols.edu/wp-content/uploads/2017/03/Massachusetts-Womens-Leadership-Index-2017-Web.pdf>



Dr Rhianna Goozee

studied Biological Natural Sciences at Cambridge as an undergraduate, and later completed a PhD in Psychosis Research at King's College London. Throughout her studies and research, she has always spent as much time as possible writing about science. Finally realising the obvious – that science communication rather than experimentation was more her bag – she left academia to become an editor and writer.

Creating Change for Women in Science, Technology, Engineering, Maths, and Medicine (STEMM)

Dr Rhianna Goozee

Growing up, we all look to those who have gone before us to inspire our academic, career, and even personal choices. While anyone can be a role model, it often helps when those preceding you have similar attributes or backgrounds to your own. Indeed, some research has suggested that this is particularly true for women, who benefit more than men from same-sex role models¹.

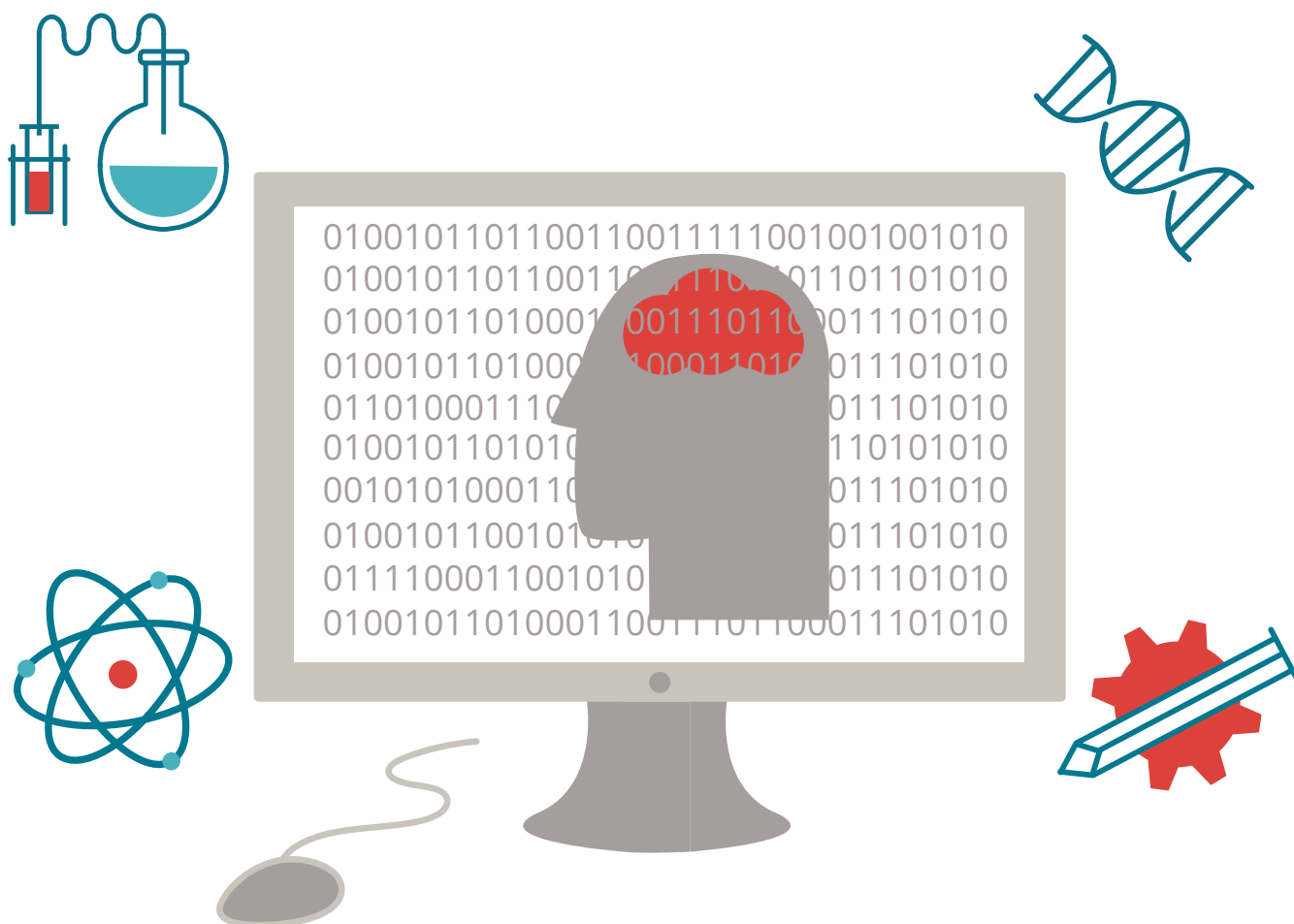
Of course, this can be problematic. While girls may study GCSE science in almost equal numbers to boys in the UK (often gaining higher grades), the drop off in numbers already begins at A level, and by the time they choose a degree there are [clear differences in the subjects taken by boys and girls](#)². When it comes to employment, the majority of people working in what are classed as science, technology, engineering, maths, and medicine (STEMM) subjects are men².

With this kind of drop out from science by women on the way up the academic and career ladder, it becomes less likely that younger girls and women will have female role models in the sciences that they can look up to and emulate. It is also a major waste of skills and talent. Science, engineering and technology are dynamic fields in which [diverse voices are required for innovation](#)³.

Therefore, this lack of representation of women in STEMM can lead us to ask several questions. Why do so many women drop out on the ascent to the top? And, what can we do about it?

The reasons for these trends are complex and varied, and while some may be institutional affecting all women, others may be individual to a particular person. There are the usual culprits, such as childrearing and caring responsibilities, which are more likely to be undertaken by women who therefore take more career breaks or require more flexible working practices (which may not be available).

Male dominated fields may also be uncomfortable places for women to work, faced by blatant or insidious sexism. In STEMM, this has been exemplified by several high profile incidents, including the comments by [Tim Hunt about female scientists in 2015](#)⁴ and regular examples of [condescending attitudes from peer reviewers towards papers by female researchers](#)⁵.



While direct action may be necessary in response to specific incidents of sexism, there needs to be systemic changes within institutions to promote greater gender equity. Reactive solutions are insufficient if we want to ensure that real change is enabled within our universities. What is needed is long-term, holistic change to the systems and culture within STEM fields.

One organisation that has attempted to tackle gender inequality and the lack of representation of women in academic STEM is the Equality Challenge Unit (ECU), which set up the Athena SWAN charter in 2005. This scheme aims to “encourage and recognise commitment to advancing the careers of women in STEM employment in higher education and research.”

Based on a Bronze, Silver, and Gold system, the charter awards universities, research institutes, or departments that commit to the principles of the charter and show progress in creating greater gender equality within their institution. Recognition begins with self assessment of the state of gender equality in an institution and developing an action plan with measurable targets (Bronze). Further progression, with evidence of good practice and impact leads to Silver or Gold awards.

As the ECU told me, a Gold award recognises institutions that are “beacons of achievement in gender equality, and should champion and promote good practice in the wider community.” Currently, there

"Science, engineering and technology are dynamic fields in which diverse voices are required for innovation"

are 669 award holders in the UK, only eight of which hold a Gold award. These have all been awarded to individual departments within a university, and there are no universities as a whole that currently hold a Gold award, although the ECU told me this is something they look forward to in the future.

The Athena SWAN charter attempts to go beyond short term, single battles in the fight against inequality in STEMM. It offers universities a framework to tackle systemic inequality, informed by data, evidence, and consultation. The impact of the scheme is continuously monitored, through consultation and independent research.

A research team at Loughborough University evaluated the charter and found evidence of sustainable change, with reports of improved visibility, increased self-confidence, and better leadership skills among women in departments holding an award. [Most interestingly, both male and female academic research staff reported greater career satisfaction and access to career development opportunities⁶.](#)

But what sort of difference can the charter make within an institution? To find out, I spoke to Sabina Khanom, Project Manager for Culture, Diversity and Inclusion at the Institute of Psychiatry, Psychology, and Neuroscience (IoPPN) at King's College London and Professor Ann McNeill and Dr Stephani Hatch, academic leads for Athena SWAN at the IoPPN.

The IoPPN signed up to the charter in 2012 and currently hold a Silver award. During their self-assessment process, they realised that they were facing huge drop out of women in the journey from student to professor. For example, while 65 per cent of postdocs were women, this dropped to less than 32 per cent at professor level.

They focused their efforts in a number of areas, including representation on committees, career development and support, HR policies and workplace flexibility (including making staff aware of how to access support), and diversity and inclusion training.

The IoPPN Athena SWAN team recognised the importance of visibility in providing role models for those early in their career. One project they implemented was to commission a series of Inspiring Women portraits of the successful female academics and researchers working at the IoPPN. These portraits are proudly displayed on the walls leading to a main lecture theatre, countering the often overwhelming dominance of portraits of men that usually grace the walls of our universities.

Khanom and her colleagues told me, "Working towards and gaining an Athena Swan Silver award has had substantial impact on the IoPPN culture and has helped to put gender inequities centre stage." Beyond this, there is now a requirement by some funding bodies, such as the National Institute for Health Research, that applicants hold an Athena SWAN Silver award to be eligible. This has provided further motivation for change and shows endorsement of the charter at multiple levels within research and academia.

I also asked the IoPPN team how they have ensured those not directly affected by inequities also contribute to equal practices within their institution (avoiding simply preaching to the choir or adding to the workload of women). They told me that their work increases transparency in committees and promotion, as well as supporting development and recognition of individuals in ways that benefit everyone. Most of their initiatives are not women only, and it is their aim to create a culture of inclusion.

"We need to stop thinking of women as a homogeneous group..."

There's still work to do. The representatives from the IoPPN told me, "We need to stop thinking of women as a homogeneous group..." Indeed, there is increasingly greater recognition of the need for intersectional approaches. With the realisation that it is not only women who are underrepresented in academic STEM, Athena SWAN has expanded their sights to other groups that may be underrepresented or face difficulties in STEMM careers. They now consider the intersections between ethnicity and gender, as well as supporting LGBTQ+ individuals.

Naturally, any attempt to change age-old systems, attitudes, and culture within an institution will likely encounter challenges and barriers to change, either from individuals or institution-wide. However, a charter such as Athena SWAN offers universities an important opportunity to assess and reimagine the ways in which they work, from student intake to the promotion and selection of their academic staff. As at the IoPPN, this can be to the benefit of all working within STEMM, allowing greater transparency, more flexible and responsive policies that fit around real lives, and hopefully a diverse workforce contributing to and enhancing the dynamic and cutting edge work conducted at UK universities.

1. Lockwood P. *"Someone like me can be successful": do college students need same-gender role models?* Psychology of Women Quarterly 2006; 30: 36-46.
2. WISE. *Women in science, technology, engineering and mathematics: the talent pipeline from classroom to boardroom.* 2014. https://www.wisecampaign.org.uk/uploads/wise/files/WISE_UK_Statistics_2014.pdf (accessed September 2017).
3. Goozee R. *Why science should welcome diverse voice.* 2016. <https://www.digital-science.com/blog/guest/science-welcome-diverse-voices-wistemspotlight/> (accessed September 2017).
4. Guardian. *Nobel scientist Tim Hunt: female scientists cause trouble for men in labs.* 2015. <https://www.theguardian.com/uk-news/2015/jun/10/nobel-scientist-tim-hunt-female-scientists-cause-trouble-for-men-in-labs> (accessed September 2017).
5. Bernstein R. *PLOS ONE ousts reviewer, editor after sexist peer-review storm.* Science. 2015. <http://www.sciencemag.org/news/2015/05/plos-one-ousts-reviewer-editor-after-sexist-peer-review-storm> (accessed September 2017).
6. Equality Challenge Unit. *Evaluating the effectiveness and impact of the Athena SWAN Charter.* 2014. www.ecu.ac.uk/publications/evaluating-athena-swan (accessed September 2017).



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The Money Shows it is a Man's World – How Can We Reduce The Difference?

Dr Michael Head

The “leaky pipeline” is a commonly used metaphor describing how there are fewer women at senior levels in academia, even when they dominate in certain subject areas at undergraduate level. For example, there are [more female than male undergraduate medical students](#)¹, and at the early-career researcher level of academia, the gender split is probably roughly even. There are, however, [far fewer women than men in senior posts at universities in the UK](#)².

But there is also a “leaky funding pipeline”, with more funding going to men than to women. My own research has previously covered the [amount of research funding awarded to male and female study leads](#)³ across 6,000 studies related to infectious disease. However we split up the data (e.g. by laboratory science, public health research, HIV studies, research into malaria, or funding awarded per year), there was a consistent trend that around 75-80 per cent of the funding in each of these areas, and indeed the overall total, was awarded to male principal investigators.

There is no evidence of gender bias on the part of the funders here (and it's not an aspect we assessed in our work). Evidence reported from the major UK funders, such as the Wellcome Trust and the Medical Research Council, suggests that [there is no significant difference in the proportions of successful grant applications led by male or female researchers](#)⁴. Thus, in this circular problem we return to the first point made where the issue is presumably therefore one that fewer female researchers are suitably senior and/or empowered to apply for research grants, especially larger awards. Our BMJ Open paper also showed that men are awarded not just more money but larger grants; this likely reflects differences in the initial amounts requested in their application by the male and female principal investigators.

So, there's a clear gap, illustrated here by the example of differences in research funding trends. Is anything being done to address the underlying issues? There are several relatively high-profile (within universities, at any rate) schemes that have equality, and the role of women in science, at the heart of their activity. The Athena Swan initiative has been rolled out across the UK, and university departments and faculties receive Gold, Silver and Bronze awards depending upon their demonstrable commitments to reducing inequalities. One reason to be optimistic about why this might

have a long-term impact is that research funders such as the National Institute for Health Research have signed up to [only allow applications from research groups who have at least a silver Athena Swan award](#)⁵. In a distinctly tricky climate for UK universities (funding cuts, Brexit etc) the threat of missing out on high-profile sources of research investment makes for an interesting motivation to ensure compliance with funder rules.

Within universities, they typically will have further schemes to enhance the development for their own staff (both male and female), such as mentoring schemes. A number of universities, including here at Southampton, have additionally implemented a programme called [Springboard](#)⁶ that seeks to support and encourage academic women's progression through the ranks.

My view is that these initiatives are a step in the right direction and [evidence is beginning to emerge](#)⁷ that Athena Swan is having some positive impact, but measuring the long-term impact of individual schemes is difficult. This is an undeniably complex world with additional factors coming into play that we really don't know how to overcome, whether it be [American faculty members rating CVs and job applications lower purely because the name at the top is obviously female](#)⁸, or the evidence that [female lecturers are consistently rated lower by students](#)⁹ without there being any obvious drop in the standard of their teaching.

Perhaps academia in the UK is pretty good now at identifying and preventing conscious gender bias, but how on earth do you begin to understand and change the subconscious bias? That's way outside

"Perhaps academia in the UK is pretty good now at identifying and preventing conscious gender bias, but how on earth do you begin to understand and change the subconscious bias?"



both my expertise and my word count for this article, so I'll leave that for others! We will need to see over the years what the numbers tell us about the number of female professors, funding trends and all the other metrics that can be useful in summarising the overall picture.

1. *Growth in the proportion of female medical students begins to slow*
http://www.gmc-uk.org/information_for_you/23490.asp
2. *One in three UK universities going backwards on female professorships*
<https://www.timeshighereducation.com/news/one-in-three-uk-universities-going-backwards-on-female-professorships>
3. *Differences in research funding for women scientists: a systematic comparison of UK investments in global infectious disease research during 1997–2010*
<http://bmjopen.bmj.com/content/3/12/e003362.full>
4. *Bridging the research gender gap*
http://www.foundation.org.uk/Journal/pdf/fst_21_09.pdf#page=24
5. *Athena SWAN*
<https://www.medschools.ac.uk/our-work/equality-inclusivity/athena-swan>
6. *Springboard Development Programme*
<https://www.southampton.ac.uk/professional-development/springboard/index.page>
7. *Advancing gender equality through the Athena SWAN Charter for Women in Science: an exploratory study of women's and men's perceptions*
<https://health-policy-systems.biomedcentral.com/articles/10.1186/s12961-017-0177-9>
8. *Science faculty's subtle gender biases favor male students*
<http://www.pnas.org/content/109/41/16474.abstract>
9. *Bias Against Female Instructors*
<https://www.insidehighered.com/news/2016/01/11/new-analysis-offers-more-evidence-against-student-evaluations-teaching>

Shut Up, Sit Back, and Listen

Dr Bastian Greshake Tzovaras

The UNESCO Institute for Statistics estimates that only [around 30 percent of researchers worldwide are women](#)¹. Similarly, according to the Economics and Statistics Administration of the US Department of Commerce only 24 per cent [of STEM jobs are held by women](#)², with individual disciplines like Engineering having a significantly worse gender bias. There's also [extensive literature on biases against women in STEM](#)³, affecting all aspects of academia, including hiring, publishing, citation counts and teaching.

Given these disheartening statistics, it is clear that there is still a long way to go before we can even start thinking about gender equality in STEM. Why is it me, a man in STEM, writing about this? Because to me these statistics also show another thing: men, who are dominating these fields, have an obligation to support women in STEM and help level the playing field. But how can men help to facilitate change and support women in STEM? All the things I try to implement are the result of listening to women - who sacrificed their spare time to educate me - and taking their advice. Thus, maybe the single best, most actionable thing is this: step back, shut up, give women space, and listen to them.

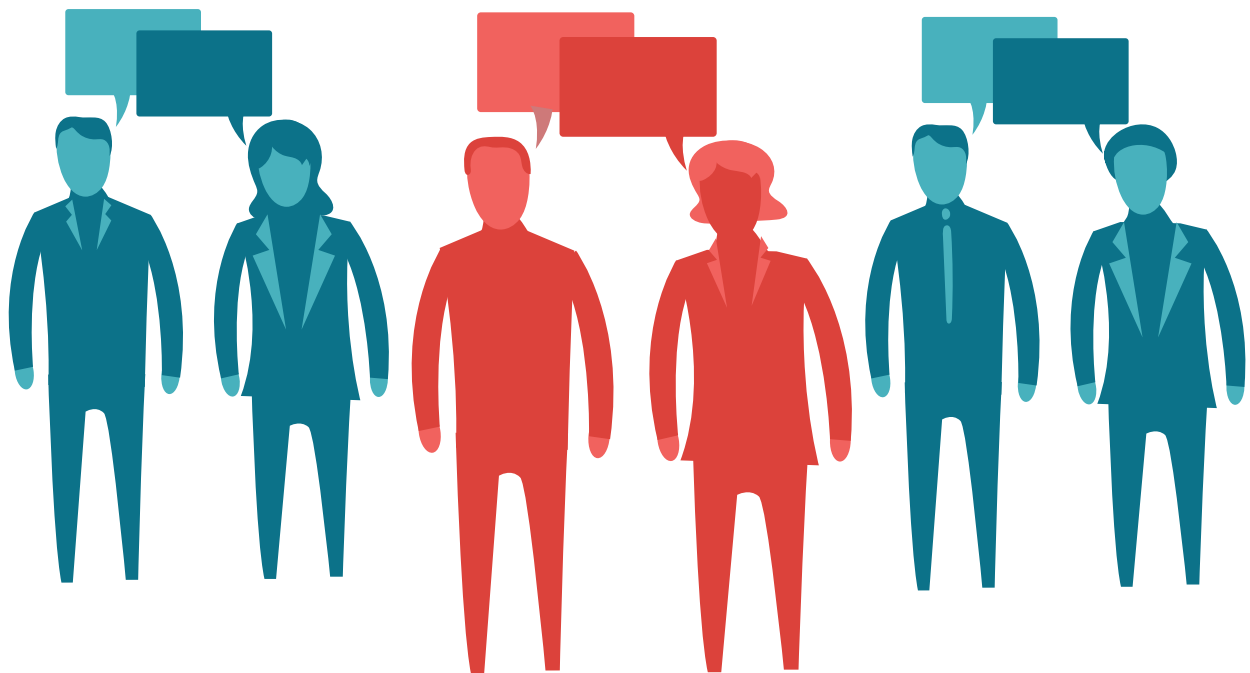
What can this look like on a more concrete level? Ask yourself about your own environments: is it men, including me, who are [taking up all the airtime at meetings](#)?⁴ Chances are that this is the case, as [women are interrupted more often than men](#)⁵ and [speak significantly less at professional meetings](#)⁶. So take a break and let others speak. [To whom are you paying attention](#)?⁷ Is it the always same male crowd? For social media some tools let you check the [gender breakdown of the people you read](#)⁸. Make sure to identify those voices you've ignored so far and listen to them. Along the same lines, ask to whom you are giving an audience. Make sure also to boost the messages of women instead of only [focusing on your \(male\) buddies](#)⁹. Generally, the male overrepresentation in STEM means you're likely to default to male perspectives. Make sure to steer actively against this.

This becomes even more important in the context of organising conferences, events or communities at large, as representation matters. Achieving a 50:50 gender split at conferences is still not a given and is the sad reason why #YAMMM (yet another mostly male meeting) and #manel are common hashtags on Twitter. Try to consult speaker databases that relate to your topic of interest (like the [Open Speakers Database](#)¹⁰ for all things open). Additional ways to counteract gender-biased presenter lineups are listed in [Ten Simple Rules to Achieve Conference Speaker Gender Balance](#).¹¹



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"Men, who are dominating these fields, have an obligation to support women in STEM and help level the playing field"

Furthermore, look at who is participating not only at your co-organised conferences, but also at your communities at large, be it a research project or a lab you are running. Do you end up having a homogenous, male participant base? This might be because the community's culture and behaviour are all but inviting for anyone else. Formulating well-stated, positive community values along with a code of conduct can help with a cultural change. [*The Diversity, Equity, Inclusion report of OpenCon offers excellent guidance and lessons learnt*](#)¹² on these topics. Kirstie Whitaker gives a good example of a [*code of conduct for the lab*](#)¹³. Lastly, you will need to enforce your code of conduct and reinforce good behaviour in your communities, as only this will lead to lasting change.

If you are not the one setting the official rules for the communities you are involved with, you can still play your part in supporting women in STEM. Ask the organisers about their gender balance amongst the presenters and decline the invitation if it is a *manel* or YAMMM. [*Be explicit about your reason for declining*](#)¹⁴ and ideally even offer them a list of women they should ask to present. In my experience this can often have a direct effect on who will speak at an event.

You can similarly push conference organisers and project leaders to adopt a code of conduct if they haven't done so already. And lastly, there is an opportunity for you to speak instead of listen: it is important that unacceptable behaviour should be called out by everyone, not only the targets of it, [*especially as men face fewer negative consequences than women for doing so*](#).¹⁵ So, step in when you observe inappropriate behaviour as well as sexist jokes and assumptions. It is what Mikka McKinnon pointedly called [*Intervene*](#).

when you see BS.¹⁶ Don't be quiet in these situations, but speak out and offer support.

This is by no means a complete list of things that men can and need to do to support women, inside and outside STEM. It does not magically solve all structural biases inherent in the current STEM environment. But I believe it makes for a good start for improving oneself, including me: take some steps back, listen to women who have all the unwanted experience in how STEM fails them, and learn how you can make a difference. Only then can you help the world of STEM to become a better place for all.

1. *Women in Science - Fact Sheet No.43*
<http://uis.unesco.org/sites/default/files/documents/fs43-women-in-science-2017-en.pdf>
2. *Women in STEM: A Gender Gap to Innovation*
<http://www.esa.doc.gov/sites/default/files/womeninstemagaptoinnovation8311.pdf>
3. *Gender Bias in Academe: An Annotated Bibliography of Important Recent Studies*
<http://blogs.lse.ac.uk/impactofsocialsciences/2016/03/08/gender-bias-in-academe-an-annotated-bibliography/>
4. *Check who's dominating the conversation*
<http://arentalkingtoomuch.com/>
5. *Influence of Communication Partner's Gender on Language*
<http://journals.sagepub.com/doi/abs/10.1177/0261927X14533197?pagetoc=&>
6. *Study: Deciding by consensus can compensate for group gender imbalances*
<https://news.byu.edu/news/study-why-women-speak-less-when-theyre-outnumbered>
7. *The Byline Survey Report*
<https://theopedproject.wordpress.com/2012/05/28/the-baseline-survey-2011/>
8. *Followerwonk* <https://moz.com/followerwonk/>
9. *On Twitter, Men Are Retweeted Far More Than Women (And You're Probably Sexist, Too)*
<http://www.adweek.com/digital/twee-q-sexist-twitter/?red=at>
10. *Open Speakers Database* <https://openspeakers.org/>
11. *Ten Simple Rules to Achieve Conference Speaker Gender Balance*
<http://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1003903>
12. *Enforcing a code of conduct*
https://sparcopen.github.io/opencon-dei-report/code_of_conduct.html
13. *Code of Conduct*
https://github.com/WhitakerLab/Onboarding/blob/master/CODE_OF_CONDUCT.md
14. *Take the Gender Avenger Pledge*
<https://www.genderavenger.com/the-pledge>
15. *Allies against Sexism: The Role of Men in Confronting Sexism*
<http://onlinelibrary.wiley.com/doi/10.1111/josi.12083/full>
16. <https://twitter.com/mikamckinnon/status/801181948504719360>



Kimberly Kowal Arcand is the Visualisation Lead for NASA's Chandra X-ray Observatory, which has its headquarters at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts. She is a leading expert in studying the perception and comprehension of high-energy data visualisation across the novice-expert spectrum. Arcand is an award-winning producer and director, and the co-author of four popular science books.

Women in Astronomy & Computer Science: There's Still Work To Do

Kimberly Kowal Arcand

"Computer science is the only field in science, engineering and mathematics in which the number of women receiving bachelor's degrees has decreased since 2002 – even after it showed a modest increase in recent years."

Selena Larson

This is my story, but it is also the story of countless others.

My career is found at the intersection of two forward-looking and fast-paced fields: astronomy and computer science. While I never mapped out this particular trajectory, it's been a compelling and fascinating journey so far – I look forward to where I can go from here.

Unfortunately, success in these STEM (science, technology, engineering, and math) disciplines is not a given for many, especially women and people of colour. Far too often, there are hurdles and obstacles – many unseen and unrecognised – to reach key milestones for those who fall outside the traditional perception and background of what a scientist, technologist, engineer or mathematician should be and where they should come from.

Those who do navigate the gauntlet of challenges and go on to have careers in the fields of STEM may have their contributions overlooked or even dismissed.

There are many who persevere, however, and Ada Lovelace Day is an opportunity to celebrate such accomplishments. While we need to look realistically at the current landscape in STEM fields for women and other underrepresented groups, we can hopefully remain optimistic that the power to change the situation lies within all of us.

Let's see where experts believe we are and where we still need to go in the two fields where I have spent most of my professional life.

In Silicon Valley, workers at major employers such as Google, Apple, and Facebook are 70 per cent male. Why are there so few women in computer science?

According to Selena Larson, key factors include an overall culture that encourages girls to play with dolls, not robots, and turn their thoughts towards more "traditionally female careers", accepting the strong stereotype, which developed in the [mid-80s](#),¹ that programmers are typically young white males. This attitude continues



into high school and well beyond. [For example](#), male students (81 per cent)² take the advanced placement computer science course at a higher rate than female students (19 per cent).

It's not all bad news, thankfully. Many individuals and organisations have worked tirelessly – particularly in recent years – to open the field of computer science to all who are interested. By 2020, it is estimated that there will be 1.4 million computer-science related jobs available in the US, but only [400,000](#)³ computer science graduates to fill them. What's being done to help women and others be included in that missing million workers?

Making Changes in Computer Science

At the university level, there has been some good news. For example, Carnegie Mellon University has been focusing on improving their computer science program with better networking and mentoring opportunities, and has recently noted that 40 per cent of their incoming computer science majors are women.

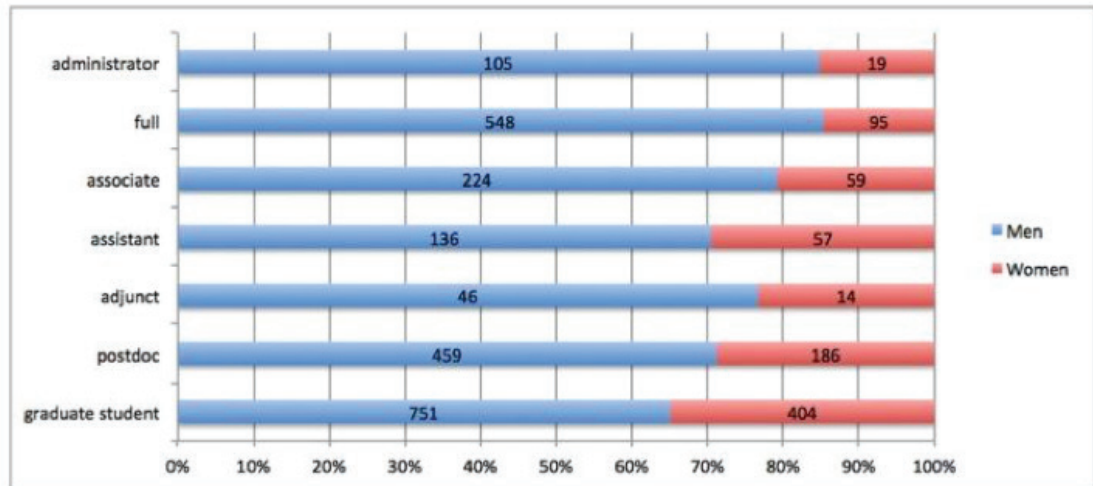
Additionally, the University of California at Berkeley redesigned their Computer Science 101 course and now [reports](#)⁴ that more women have been enrolling in the course than men.

I also work in the field of astronomy – it allows me to explore the farthest reaches of the universe and communicate what scientists find with anyone who is interested. Astronomy has a long history of women making incredibly significant contributions to the field; however it also has similarly been known to exclude and exhibit bias towards women.

"Many individuals and organisations have worked tirelessly – particularly in recent years – to open the field of computer science to all who are interested."

Astronomers: 2013 snapshot and changes over time

The American Astronomical Society (AAS) Committee on the Status of Women in Astronomy (CSWA) is crucial to tracking data and reporting on trends for women in the field. The following charts are reproduced from their report, [January 2014 Status – A Report on Women in Astronomy](#),⁵ and help show the “fractional representation” facing women in astronomy.



Source:
AAS CSWA

Snapshot of gender demographics of astronomers as of January 1, 2013. Shows all levels, including administrators & adjuncts). The fraction of women decreases with seniority in the field.

If we then take a quick look specifically at astronauts: Over 560 people have trained to be astronauts to date, but only 75 astronauts have been female.

	2003 POSTDOCS	2013 ASST PROFS	% ADVANCEMENT
MEN	549	106	19±2%
WOMEN	235	37	16±3%
% WOMEN	30±2%	26±4%	
	2003 POSTDOCS	2013 ASSO PROFS	% ADVANCEMENT
MEN	47	194	41±3%
WOMEN	130	50	38±6%
% WOMEN	22±2%	20±3%	

Source: AAS CSWA

	1992 GRAD STUDENTS	2003 ASST PROFS	% ADVANCEMENT
MEN	602	182	30±3%
WOMEN	176	31	18±3%
% WOMEN	23±2%	15±3%	
	1992 POSTDOCS	2003 ASSO PROFS	% ADVANCEMENT
MEN	301	157	52±5%
WOMEN	63	39	62±13%
% WOMEN	17±2%	20±4%	

Survival analysis of men and women over the two decades of the surveys

Some astronauts can face challenges to become certified to do spacewalks, if, for example, they are of a smaller stature. Spacewalks require [special suits](#)⁶ that are not tailor made, but rather come in medium, large and extra-large sizes. Recently retired astronaut Cady Coleman, for example, at 5'4" is [likely NASA's smallest astronaut](#)⁷ able to wear a spacewalk suit; astronauts smaller than her would not be able to fit in and manoeuvre around in the spacewalk suit.

There is still much to be done, but there is real reason to be positive for the field of astronomy today. Within the past couple of years, women and men have used social media to shine a light on, and perhaps put a stop to, several examples of sexual harassment in the field and galvanise support for the victims. By banding together, people who support equality and a level playing field for all have been able to create communities which are capable of standing up to the 'old boys' network that has existed for so long.

Moving Forward in Astronomy

In the past ten years, CSWA reports that institutions of higher education have been able to recruit and retain more women into assistant professor positions in astronomy than before. In 2013, NASA's second-in-command said more women are needed amongst its ranks. Out of 18,000 civil service employees, about 6,000 are women, according to [Business Insider](#),⁸ and the current class of eight NASA astronauts is made up of 50 per cent female, and 50 per cent male members. Taken from [Space.com report](#)⁷:

"I was in college when Sally K. Ride flew and frankly I don't think I really paid attention to the space shuttle program until STS-7, [Ride's first flight]," said Lori Garver, NASA Deputy Administrator, in the Space.com report. "She had a great influence on me. She shaped my life in this program... role models do, in fact, matter. We've all in a way been touched by Sally."

For me, Ada Lovelace Day is an opportunity to take stock of the situations that currently exist in STEM fields and renew my resolve to speak up and speak out where I can. We can change things. We can reach out, extend our hands, and help lift others up. We can open doors that have long been shut to too many, and we can build new doors where none currently exist.

1. *When Women Stopped Coding* <http://www.npr.org/sections/money/2014/10/21/357629765/when-women-stopped-coding>
2. *State of Girls and Women in STEM* <https://ngcproject.org/statistics>
3. *Computer Science is for Everyone!* <https://obamawhitehouse.archives.gov/blog/2013/12/11/computer-science-everyone>
4. *Why So Few Women Are Studying Computer Science* <http://readwrite.com/2014/09/02/women-in-computer-science-why-so-few/>
5. *The 2013 CSWA Demographics Survey: Portrait of a Generation of Women in Astronomy* <http://womeninastronomy.blogspot.co.uk/2014/03/the-2013-cswa-demographics-survey.html>
6. *When It Comes to the Spacewalk, Size Matters* <http://www.npr.org/templates/story/story.php?storyId=6627320>
7. *NASA Needs More Women, Top Official Says* <https://www.space.com/22175-nasa-needs-women-sally-ride.html>
8. *Meet The Beautiful Women Who Send Rockets Into Space* <http://www.businessinsider.com/the-women-of-nasa-2012-8?IR=T>



Dr Buddhini Samarasinghe

has a background in molecular biology and cancer research. Her writing can be found at [Jargonwall](#)¹. She is also the founder of [STEM Women](#)², an initiative dedicated to promoting and celebrating women in STEM. As a passionate science communicator, she engages with the public by demystifying research in the life sciences. Follow on Twitter @[DrHalfPintBuddy](#).

Blind Spots: Seeing Sexism in STEM

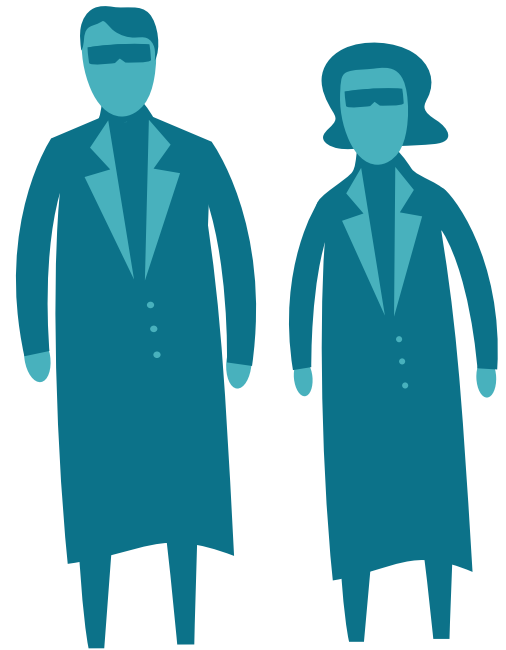
Dr Buddhini Samarasinghe

Two years ago I created STEM Women, an initiative that celebrates the careers of women in STEM fields while highlighting the many difficulties we face. It is important to identify and draw attention to the challenges facing women in STEM as well as the attitudes and behaviours which allow their marginalisation in the academic world.

One long-standing problem in STEM is sexism which is widespread and comes in many forms, but may not always be easy to recognise. It can be subtle and insidious, intrusive and unasked for. The looks, questions, comments, jokes, impediments and double standards; the (perhaps unconscious) marginalisation of women from collegiate discussions, activities and spaces. Unfortunately, even well-intentioned male colleagues can perpetuate it. If we have trouble recognising sexism, we are not equipped to address it. Ostensibly even-handed comments – “maybe you misunderstood what he meant” – defend the abusers and cast doubt onto the victims. While the trolls are easy to spot, it is much harder to point out the blind spots that fester in well-meaning colleagues who believe they are being fair.

Even seemingly innocuous conversational topics can marginalise women: context makes a huge difference. It's a disconcerting fact that men tend to talk to one another about their research but with their female colleagues they mostly discuss their social life. The bias is unconscious, but it is real, and it affects women in STEM. Worse still, even when men discuss research with female colleagues, they can do so in ways distinct from their approach towards male colleagues. Male-male discussions leave the participants mentally boosted; male-female discussions can end up demotivating women. Men must proactively involve women in conversations, and consciously reject gender stereotypes, even though it is not easy.

Actively listening to the needs of the people around you is an essential leadership skill, and it always surprises me how few people are able to listen to women sharing their experiences in STEM without feeling the urge to interrupt. Monopolising the conversation can marginalise female colleagues and by implication, belittle their contributions. Similar problems can also be experienced by those in different racial groups or of different sexual orientation. The voice of the oppressed must not be drowned out by lectures from those who said they would listen.



It is easy to identify the misogynists, the trolls, the sexists who think women should simply stay at home instead of following their ambitions. It is easy to ignore these voices, because they are – thankfully – a shrinking minority, and their views are so obviously wrong. We have made tremendous progress; a few decades ago it was rare for a woman to pursue a STEM subject. Yet inequality persists; it is now simply harder to identify. We need to acknowledge it as such, and then together find ways to combat it.

"Even seemingly innocuous conversational topics can marginalise women: context makes a huge difference."

1. *Jargon wall* <http://www.jargonwall.com/>
2. *STEM Women net* <http://www.stemwomen.net/>



Stacy Konkiel is the Director of Research & Education at Altmeteric, a data science company that uncovers the attention that research receives online. Her research interests include incentives systems in academia and informetrics, and Stacy has written and presented widely about altmetrics, Open Science, and library services. She also currently chairs the Innovation committee of [Library Pipeline](#)¹ and is building the [Metrics Toolkit](#)². Previously, Stacy worked with teams at Impactstory, Indiana University & PLOS. You can follow Stacy on Twitter at [@skonkiel](#).

Does Research Evaluation in the Sciences Have a Gender Problem? What Do Altmetrics Tell Us?

Stacy Konkiel

How do we measure and evaluate productivity in scientific research? Counting papers published per year isn't useful. Research has shown that [female researchers tend to publish less](#)³ than their male counterparts in several scientific fields, [especially early in their careers](#).⁴

Measuring collaboration is equally tricky. [Women tend to collaborate less than their male counterparts](#)⁵ ([especially less often internationally](#))⁶ and [have different collaboration strategies than their male counterparts](#).⁷

Then there's bibliometrics. Citation counts aren't sexist, but citation practices can be. [Many studies have found](#)⁸ that, [no matter the authorship position](#)⁹ of a female researcher, she is less likely to be cited than her male counterparts.

Might [altmetrics](#)¹⁰ be better suited to help understand the influence of research in a more gender-balanced way? Altmetrics are data from the social web that help us understand how research is discussed, shared, reviewed, rated, and reused by other researchers and members of the public.

The jury is still out on whether altmetrics show a gender advantage for male researchers over female researchers. In fact, in some fields and for certain types of altmetrics, women actually have an advantage over their male counterparts when it comes to altmetrics for their work.

[Bar-Ilan and van der Weijden \(2015\)](#)¹¹ found that for papers published prior to March 2014, female astronomers and astrophysics researchers have slightly higher Mendeley readership numbers on average, but that men are better represented on the academic social bookmarking site overall.

[Haustein, Paul-Hus, Sugimoto & Larivière \(2016\)](#)¹² looked at articles from a larger cross-section of disciplines and found that a gender gap exists for social media altmetrics for publications from 2013, but to less of an extent than for citations. Some disciplines were found to be mostly gender-balanced (mathematics, arts, humanities, health, psychology), while others showed that both men and women lead authors had dominance based upon the social media platform studied (biology, biomedical research, earth and space sciences, engineering and technology, professional fields, and social sciences).

Interestingly, a majority of Open Access journals studied by [Sugimoto & Larivière \(2017\)](#)¹³ in chemistry and the interdisciplinary sciences showed an advantage for female lead authors, especially those publishing in first author positions. The authors suggest that the results show “that these venues provide particular visibility for younger female academics on social media.”

More recently, I looked at the data for how male and female lead authors¹ compare when one examines at the overall attention that their work receives online (which can be approximated by the Altmetric Attention Score), and more specifically in the media and public policy documents.

Across all papers published in 2016 from Web of Science where lead author gender was known (N = 1,849,326), male lead-authored papers were more prevalent than female lead-authored papers, by a ratio of 2.5 to 1. But we already knew that men lead author papers more often than women, didn't we?

Looking more closely at a subset of articles published between January and March 2016, 85,277 had received attention in the sources that Altmetric tracks. Male lead-authored papers with any Altmetric data (n = 52,821) were represented 1.6 to 1 over female lead-authored papers with any Altmetric data (n = 32,456).

This gender discrepancy differs from what Haustein *et al* (2016) found – 29 per cent of female lead authored papers in their sample from 2013 had any Altmetric attention, compared to 19 per cent of male lead authored papers. Taken together, one finds a hint that gender discrepancies might reverse over time: my findings suggest that men's work may be talked about more online over the first year or so after publication, but over time, Haustein *et al*'s data indicate that female lead authored papers eventually get more than their due.

The gender discrepancies seem to stop there. There was no difference in overall attention being paid to research online, as measured by the

"In some fields and for certain types of altmetrics, women actually have an advantage over their male counterparts when it comes to altmetrics for their work"

¹. Thanks to Sugimoto & Larivière, who enthusiastically granted me access to their comprehensive dataset of publications with dominant authorship by gender.



median Altmetric Attention Scores for the papers I looked at (a median Score of 2 was found for both male and female lead-authored papers).

Of the male lead-authored papers published in Q12016 with Altmetric attention, 7,165 (13.6 per cent) had at least one mention in the news, and 492 (0.9 per cent) had at least one citation in a public policy document. Female lead-authored papers had roughly similar rates of attention in the news and in public policy documents: 4,288 (13.2 per cent) had at least one news mention and 347 (1 per cent) had at least one public policy citation. The median number of mentions in news articles and public policy documents showed no gender difference (a median of 1 was found for attention in both sources, for both male and female lead-authored articles).

The relative gender balance of altmetrics should be heartening to all researchers. It means that a conscious engagement and impact strategy for one's research, carefully applied, will not necessarily be hindered by implicit bias in the same way that citations can sometimes be.

For those researchers in the fields of biology, biomedical research, earth and space sciences, engineering and technology, professional fields, and social sciences – disciplines where gender biases have unfortunately been shown to exist – carefully planned outreach strategies may help balance the playing field.

For more information on developing outreach and impact strategies for your research, check out these resources:

- [The 30 Day Impact Challenge](#) [ebook, 2015] [14]: a primer on using social media and other online outreach strategies to raise your professional, scholarly profile on the Web
- [The Research Impact Handbook](#) [ebook, 2016] [15]: a guide to developing strategies for long-term impact for your research in both the scholarly and public spheres

1. *Library Pipeline* <https://www.librarypipeline.org/>
2. *Results of the FORCE 2016 Innovation Challenge* <http://stacykonkiel.org/force2016-innovation-challenge/>
3. *Gender, Children and Research Productivity* https://www.researchgate.net/publication/227090293_Gender_Children_and_Research_Productivity
4. *Measures of Sex Differences in Scientific Productivity* <https://academic.oup.com/sf/article-abstract/71/1/159/2232637/Measures-of-Sex-Differences-in-Scientific>
5. *Child Care, Research Collaboration, and Gender Differences in Scientific Productivity* <ftp://ftp.ige.unicamp.br/pub/CT001%20SocCiencia/25%20de%20Outubro/Kyvik%201996.pdf>
6. *Bibliometrics: Global gender disparities in science* <http://www.nature.com/news/bibliometrics-global-gender-disparities-in-science-1.14321#/b7>
7. *How do men and women differ in research collaborations? An analysis of the collaborative motives and strategies of academic researchers* <http://www.sciencedirect.com/science/article/pii/S0048733311001296>
8. *Gender Differences in Publication Output: Towards an Unbiased Metric of Research Performance* <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0000127>

9. *Bibliometrics: Global gender disparities in science* <http://www.nature.com/news/bibliometrics-global-gender-disparities-in-science-1.14321>
10. *altmetrics: a manifesto* <http://altmetrics.org/manifesto/>
11. *Altmetric Gender Bias - An Exploratory Study* <http://www.orb-academic.org/index.php/journal-of-computer-science/article/view/122>
12. *Is there a gender gap in social media metrics?* https://www.researchgate.net/profile/Adele_Paul-Hus/publication/280080757_Is_there_a_gender_gap_in_social_media_metrics/links/55a6d21b08ae410caa7507a2/Is-there-a-gender-gap-in-social-media-metrics.pdf
13. *Altmetrics: Broadening Impact or Amplifying Voices?* <http://pubs.acs.org/doi/pdf/10.1021/acscentsci.7b00249>
14. *The 30-Day Impact Challenge* <http://blog.impactstory.org/research-impact-challenge-ebook/>
15. *The Research Impact Handbook* <http://www.fasttrackimpact.com/research-impact-book>

Closing Thoughts From Digital Science

Laura Wheeler

This report explores the role of women in STEM and the challenges they face, looking at areas of gender inequality, exploring potential causes of this inequality and offering solutions. Women's reluctance to step into leading roles, their tendency to suffer from "imposter syndrome" and their career breaks as a result of motherhood, are just some of the contributory factors holding them back, as well as the outdated, sexist attitudes they sometimes have to face in the workplace.

It is clear that proactive responses from the research community are needed in order to resolve these issues, creating a cultural change that will allow more women into management roles. Mentors can help encourage women to become more confident in their own abilities and accept opportunities which open up to them. Feedback from the academic community is also an important factor in measuring the rate and range of change.

The aim of achieving full diversity is not simply an ethical one - it also makes good business sense: diversity of thought will help us to achieve our best science and research. Improvements en route to equality have already been put into practice and we can measure the successes of many of these initiatives, but we cannot afford to become complacent. There is still a long way to go.

In recognition of Ada Lovelace Day, we hope the report is thought-provoking and provides an incentive to become involved in helping us achieve "the tipping point". Please let us know what you think and we will be pleased to receive any suggestions which could assist us in reaching our goal.

"The aim of achieving full diversity is not simply an ethical one - it also makes good business sense"



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