Editorial

Ada Lovelace, a role model for the ages

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Ada Lovelace Day celebrates women in STEM careers, but also raises awareness of the challenges that women have faced in science, as well as the importance of female role models in STEM.

More than seventy years before the invention of airplanes, twelve-year-old Ada Lovelace dreamed of a world where she could fly, leading her to observe birds, investigate different materials that could be used as wings, and eventually write a guide called *Flyology*. Her curiosity and imagination, though, did not stop there. A mathematician and a writer, she met inventor Charles Babbage at the age of seventeen when he was working on a machine called the Analytical Engine, which was a precursor to the modern computer. Fascinated by it, Lovelace translated a paper on this machine, wherein her notes were three times the length of the original study. Lovelace's insights into the potential of the machine went beyond mere calculations, as she envisioned its ability to compute any form of information that could be represented with numbers and operations[1]. The algorithm that she designed for the Analytical Engine to calculate Bernoulli numbers using a recursive mechanism is what makes her recognized as the world's first computer programmer[1].

Lovelace's contributions to the science, technology, engineering and mathematics (STEM) fields do not end there, and her theories about the capabilities of the Analytical Engine are still relevant to this day. In her notes, she argued that "the Analytical Engine has no pretensions whatever to originate anything" and that "it can do whatever we know how to order it to perform"[1]. This assertion remains relevant in the present day as artificial intelligence (AI) continues to gain prevalence in our daily routines. The Lovelace Test was proposed by Selmer Bringsjord, Paul Bello and David Ferrucci[2] to validate her theory that computers will only have 'minds' once they can create something original and independent of human input. With her sharp insights into the potential of computing devices, she was able to envision a challenge that has not yet been met these days.

Her groundbreaking achievements, however, went largely unrecognized during her lifetime, mirroring the unfortunate experiences that women in STEM fields have faced throughout history. A number of historians have also raised questions about the extent and significance of her work, giving scathing interpretations of her expertise[3]. Lovelace's story exemplifies how deeply ingrained stereotypes and biases can hinder recognition of women's contributions to STEM, as her work was overshadowed by Babbage's reputation. More than two centuries have passed since Lovelace's time, and Katie Bouman — the researcher who led the development of the algorithm that generated the first ever image of the black hole — received similar criticism, with some people questioning the extent of her contributions[4]. Clearly, the situation for women in STEM still has a long way to go before we can achieve complete equality.

A major takeaway from Lovelace's story is the need to provide education and opportunities to girls at a young age. Daughter of a renowned poet and an educational reformist, she had access to advanced mathematics education at a time when girls were denied even basic schooling. Statistics have shown that women are underrepresented in STEM, a trend that is seen across different fields. This is also a consequence of the leaky pipeline, a phenomenon where the proportion of women decreases with each career level[5]. The gender gap in STEM fields is a persistent issue that hampers progress and limits diverse perspectives. Stereotypes, bias, and a lack of representation continue to dissuade young girls and women from pursuing careers in STEM.

There have been multiple initiatives to help get more women in STEM fields, such as Girls Who Code and Bioinfo4Women. Nevertheless, a major challenge to accomplish this task is providing mentorship to young girls who need to see women in leadership roles, as studies have shown that women are more inspired by outstanding females than male role models[6,7]. It was with this goal in mind that Ada Lovelace Day was conceived. Celebrated on the second Tuesday of October since 2009, Ada Lovelace Day is a platform for celebrating the achievements of women in STEM fields and for encouraging young girls to pursue careers in these disciplines. It prompts us to reflect on the progress made towards gender equality in science and technology, as well as the work that still needs to be done.

Lovelace's story stands as a symbol of the gender gap in STEM fields, while also representing the immense potential that lies within women in these areas. It is crucial that we continue to recognize and highlight the achievements of women like Lovelace, who defied societal norms and made invaluable contributions to the fields of science and technology. To celebrate Ada Lovelace Day, we at *Nature Computational Science* talked to some (of the many) female researchers about their work, gender disparity in STEM, and the steps we can take to overcome these challenges. We welcome you to explore these conversations in our Special issue that celebrates women in STEM.

Closing the gender gap in STEM is not just a matter of fairness; it is essential for creating a better future. By embracing diversity and promoting gender equality, we can unlock untapped potential and drive innovation. The breakthroughs and discoveries of tomorrow will depend on the creativity and collaboration of people from all backgrounds.

References

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