

# Women Engineers: “Really?”

## *Alba Proffe*

Women are a rare sight in engineering courses. This is especially true at ETH Zurich. It promotes a cutting-edge study of “Maschinenbau” with antiquated images of men and machines. And it does too little to attract female talent.



Image 1: One of the few women engineers at ETH is an allegorical sculpture from 1896. She stands in the main building.

*Scenario at a party on December 8<sup>th</sup>, 2018. Conversation between a man of my age and me:*

*Man: "So what do you study?"*

*Me: "I study mechanical engineering"*

*Man: "Really?!" (looking astonished)*

*Me: "Yes!! What about you?"*

*Man: "Me too, actually"*

At a first glance, you would imagine that his question seems justified since there are not many women studying mechanical engineering at ETH (9.6% enrolled in the Master's Program in 2017). In fact, all people I met for the first time were astonished when I told them what I studied. Until that day, I believed their astonishment came from the idea that I had to work in a boiler suit or repair an engine or a machine in my field of studies (a traditional image of a person in the mechanical craft and technology field which is until today outnumbered by men).



Image 2: Engineers do not always wear boiler suits and, even historically, they were not always men. Kitty O'Brien Joyner (1916--1993) was the first female american engineer to work for NASA.

## ENGINEERING AT ETH: A DIFFICULT TERRAIN FOR WOMEN

But the astonishment from one of my fellow students made me realize that the reason he just could not believe that I studied something technical lies in the lone fact that I am a woman (who looked feminine, because else it would be 'understandable' for him, I guess). Of all people, a man who studies the exact same subject at the exact same university as me

should know what we do in a mechanical engineering program. He should know that women with enough motivation and interest in the subject are as suited as men to become engineering students at ETH.

With this little introduction I would like to open the discussion about the real problem here: **Why is mechanical engineering outnumbered by men?** Since when is it perceived as a problem and does it seem to change? What does ETH or our Department for Mechanical and Process Engineering (D-MAVT) do about it?

In order to understand the history of mechanical engineering at ETH, let's review briefly why women weren't encouraged to do science prior to the industrial revolution. During the Enlightenment, a period which lasted from mid 17<sup>th</sup> until the end of 18<sup>th</sup> century, philosophers and scientists believed that *passions* – emotions like lust, greed, jealousy and anger – were interfering with the reasonable functioning of the mind. In order to be a good scientist back then, one had to restrain all kind of *passions*: scholars had to train their minds by performing diet, regimen and abstinence.[1] It was also believed that *passions* were one of the main characteristics of the female gender and that women did not have enough self-control to discard these *passions* completely. Therefore, women were thought to be unsuited to do science.

As engineering became a popular field of applied science with the industrial revolution in the 19<sup>th</sup> century, ETH opened its doors in 1855 and women were explicitly entitled to study there. However, they were not encouraged by society to go to university since well-respected women at the time were meant to stay at home being wives and mothers in the first place. As a matter of fact, there were no upper secondary schools for girls in Switzerland. This meant that only women from abroad could benefit from the female admission to ETH. The first female student at ETH was Nadezda Smeckaja from Russia, who enrolled for a mechanical engineering degree in 1871.[2]

During the 20<sup>th</sup> century, the number of women enrolled in a mechanical engineering program was almost zero. To give you a rough idea, the first year more than four women enrolled in mechanical engineering was in 1974 (compared to 791 men that year).[3]

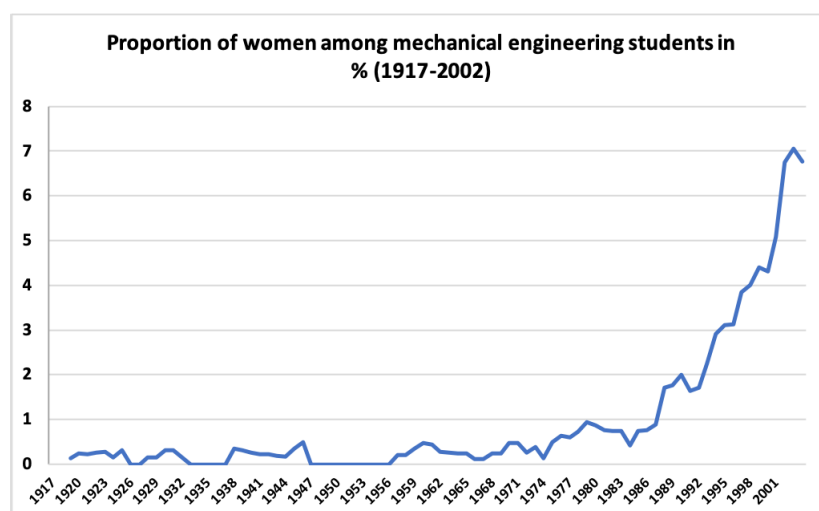


Figure 1: Proportion of women enrolled in mechanical engineering from 1917 until 2002.



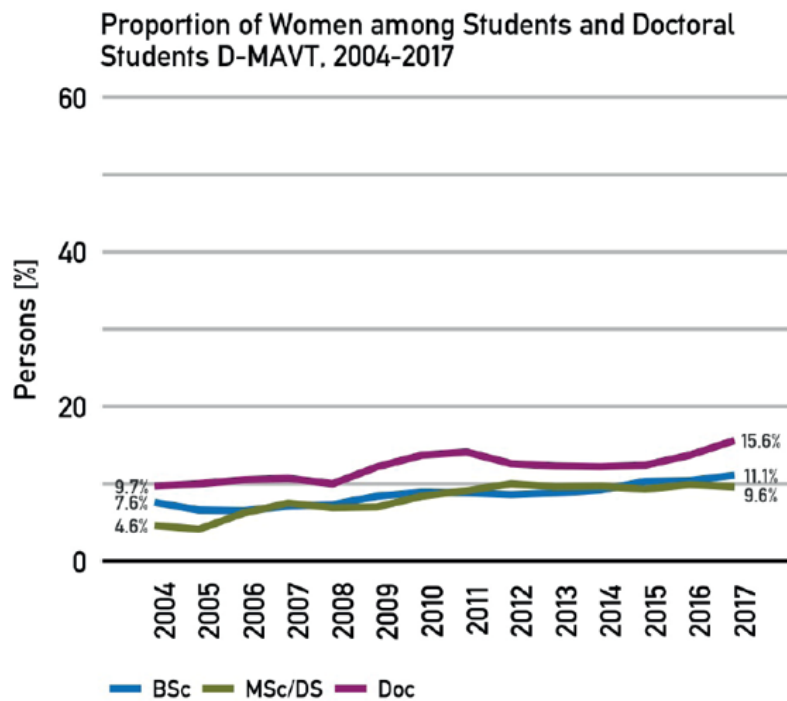


Figure 2: Proportion of women enrolled in mechanical engineering from 2004 to 2017.

## ENGINEERING IS MORE THAN 'MASCHINENBAU'

Compared to the overall number of women at ETH (31.4% of all students in 2017) or other fields of study like materials science or pharmaceutical sciences, the number of women in mechanical engineering has not increased drastically since the 1970s (see Figures 1 and 2). The current percentage of women enrolled is about 10%. So why is mechanical engineering still so unattractive for women?

Firstly, when people imagine what mechanical engineering is, they depict a turbine, a car, a pump or an aircraft: basically, anything that has to do with a machine. This is especially true in German-speaking countries where this study program is called 'Maschinenbau' which literally means 'building of machines'. The study program along with its name originate in the Industrial Revolution in the 19<sup>th</sup> century when cutting-edge machines like the steam engine were invented. The socially constructed stereotype of women not being able to handle machines has led to the conclusion that women could not study mechanical engineering. The problem is that mechanical engineering studies nowadays have little to do with machines while the stereotype still persists. The study program has become a very broad field including – to name just some – biomedical technology, mechatronics and robotics, micro- and nano- technology, design and mechanics of materials and the more traditional energy processes or production techniques.

The second reason why mechanical engineering is not perceived as very attractive for women is the common gender bias in engineering workplaces and its resulting atmosphere in post-doc positions at university or in some companies. Most engineering projects require dynamic group work: colleagues sit together and develop a new idea or improve an existing one. Most of the time, women are welcome to be part of the team. Their ideas will often be heard but oftentimes (subconsciously) not given the same attention as the ones of their male counterparts. Women have to make an extra effort to prove that they are as qualified

as men. This can clearly be seen in the glass ceiling index (GCI) illustrating the chances of women being promoted in academia as a full or associate professor, relative to their number. A GCI of 1 means that women's chances are equal to men's, and a GCI over 1 means that women are underrepresented. The higher the value is above one, the 'thicker' is the glass ceiling (see Figure 3). In 2017, the GCI for D-MAVT was 3.77: it had worsened to a number which was almost as bad as six years before, while the overall GCI at ETH is decreasing slowly over the past few years reaching as low as 1.97 in 2017.[4]

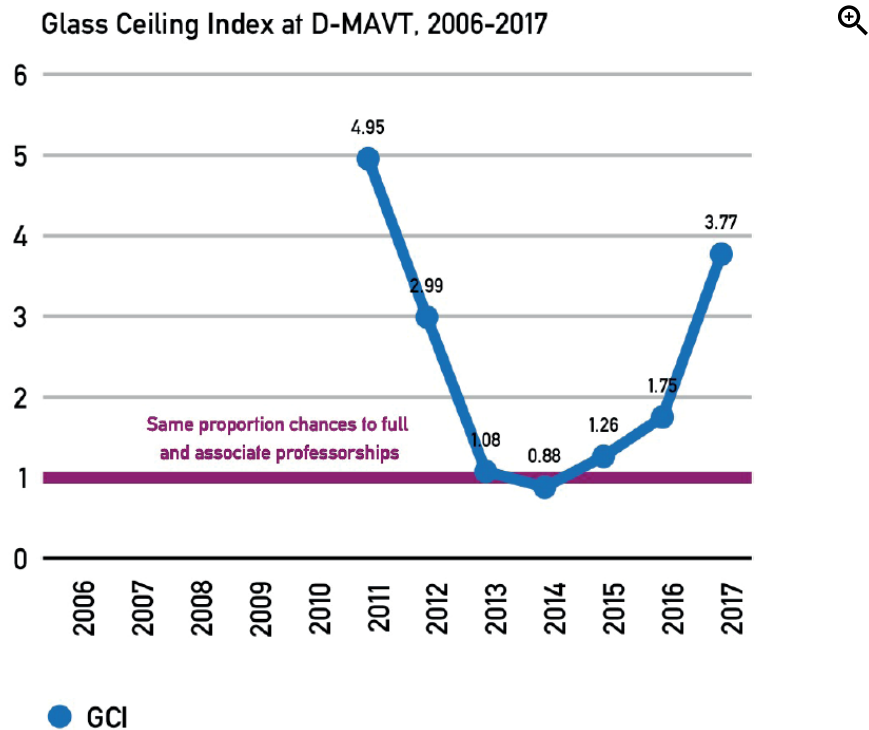
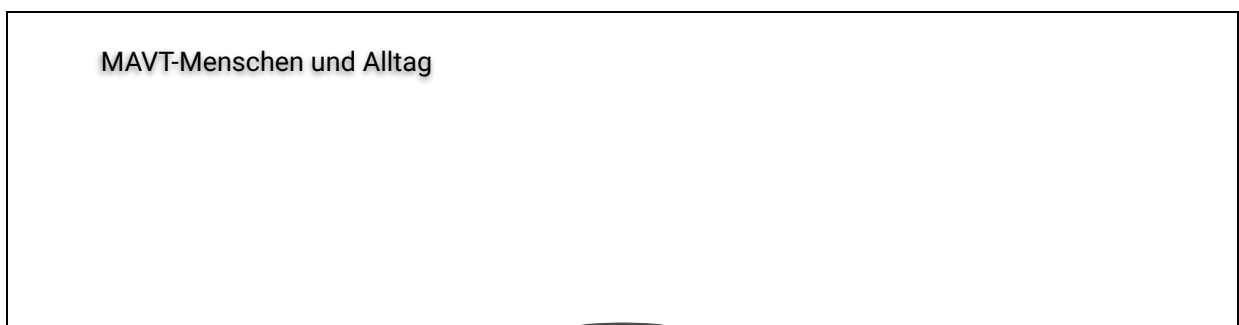


Figure 3: Glass Ceiling Index in Mechanical Engineering at ETH.

### WHERE ARE THE FEMALE ROLE MODELS?

Another reason why young women are not attracted to mechanical engineering in particular is because they simply do not know that there are (at least some!) women active in this field. The lack of female 'role models' like well-known professors and the lack of publicity from technical universities specifically targeting young women is an obvious phenomenon. The latter can clearly be seen on the ETH website informing about all study programs: The promotional video for mechanical engineering (see below) from our department D-MAVT depicts a group of (male) students working on a race car eight seconds into the clip and more than 20 men interviewed in total compared to only three women.





## THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT) MAKES AN EFFORT

MIT has found out that publicity played a huge role in motivating women to study mechanical engineering. It is basically a chicken-and-egg cycle: the more women are represented on campus, the more women are going to apply for the program. This worked perfectly for MIT after they specifically focused their campaign onto attracting more female students: in 2017, 49.5% of the students enrolled in mechanical engineering in the bachelor's program were women (compared to 11.1% at ETH). Additionally, it is also important for women to have female role models in mechanical engineering so that they can relate to someone and see that there is a chance for women to have a successful career. A role model would be a well-known professor for example. But also in regard to the number of professors, women are largely outnumbered by men at D-MAVT: in 2017, only three were female (one full professorship and two associated professors, see Figure 4) accounting for 8.2% of the professors. We can see that there is still a long way to go for women to attain the same number of professorships like men at our department. When more female mechanical engineering professors will be well-known, there might be a bigger chance for women to enroll in a mechanical engineering degree.

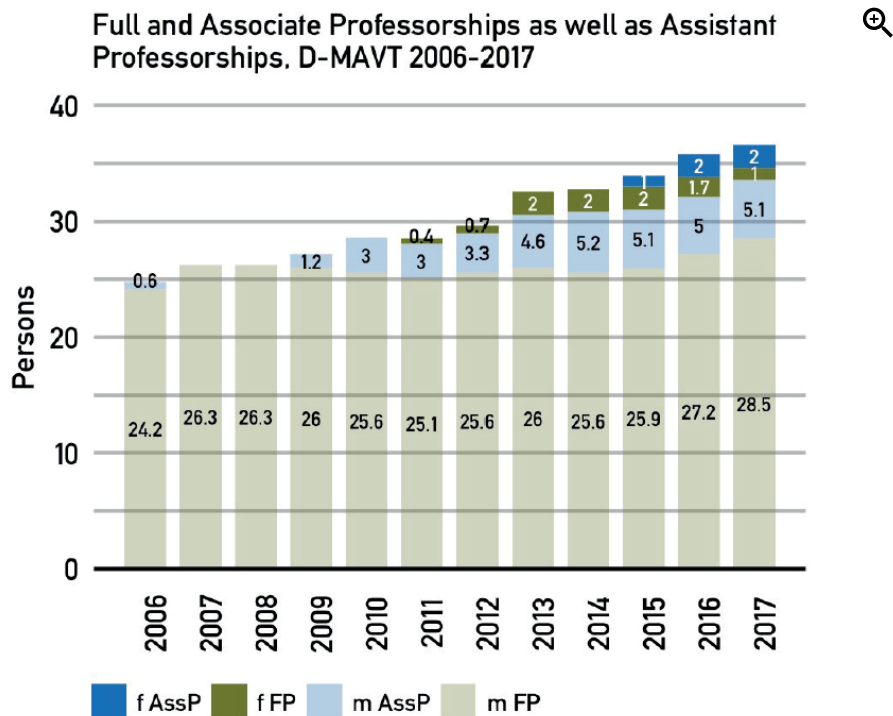


Figure 4: Number of full and associated professorships at D-MAVT.

## 'YOU STUDY MECHANICAL ENGINEERING?' - 'ME TOO!'

To conclude, the fact that men outnumbered women in mechanical engineering when the field was 'created' in the 19<sup>th</sup> century has mainly something to do with the fact that women did not have an easy access to upper education in science at that time. It wasn't until the 1920s that women started to increasingly enroll at ETH, but the engineering field and especially the mechanical engineering program remained almost absent from women until the 70s. The popularity of this subject is still low among women as of today, but I believe that the trend shows an increase in the enrolment numbers, making me confident that there will be more female mechanical engineers in the future.

Hopefully, a conversation between a male student and me sound will soon sound like this:

*Man: "So what do you study?"*

*Me: "I study mechanical engineering"*

*Man: "Me too! In what semester are you?"*

*Me: "In the third. How about you?"*

*Man: "I'm in the first semester, I have just begun to study here. Do you mind looking at my mechanics homework and help me with this exercise I don't understand?"*

*Me: "Sure, I would love to help!"*

### Autor\*in

Alba Proffe is finishing her master's thesis in mechanical engineering at ETH Zurich. She also was active in encouraging girls in Switzerland to study MINT subjects.

### Abbildungsverzeichnis

Image 1: ETH Library

Image 2: Wikimedia Commons

Image 3: ETH History – Statistiken

Images 4–6: ETH Equal! – Gender Monitoring 2017/18

### Seminar

This text was drafted in the seminar 'Science and Masculinity in History: A global Perspective' in the autumn semester 2018.

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