7. Scientificity and gender: Ways of seeing, ways of knowing

By Professor Cecilia Åsberg

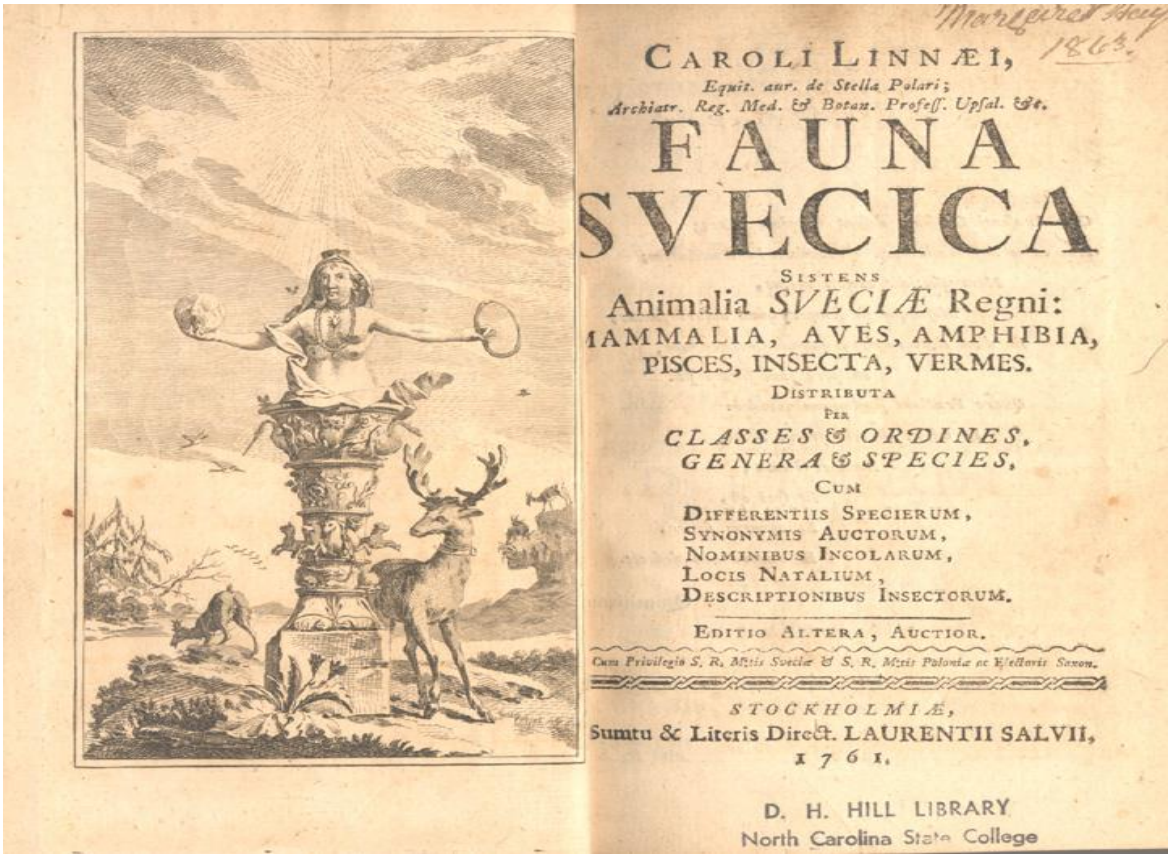
This text is part of a series of publications on gender research and gender equality that has been produced by researchers at KTH as part of the efforts at KTH to integrate knowledge about gender equality, diversity and equal conditions in education. The purpose of the series is to disseminate, in an accessible way, knowledge from gender research in various subject areas that are relevant to students, doctoral students and teachers at KTH.

The aim of this text is primarily to provide an overview of how gender has impacted the conditions for production of knowledge in Europe, historically and in the now. The text gathers insights from feminist philosophy of knowledge, the history of science, gender studies, science and technology studies, as well as art history and visual studies of science and technology culture in society. Hopefully this can help us reflect on the taken for granted, but changeable, values that engender our shared notions of scientificity. For instance, this text provokes reflections on the conditions for and history of knowledge, on *who* traditionally gets to know things. It exhibits the pattern on who or what is deemed to be a *scientific subject* (a person with the authority to know something) or a *scientific object* (things or resources about which something may be known), and it points to how we can improve conditions for the production of knowledge in a more democratic and thus sustainable direction today.

Creation of knowledge

Theory of knowledge, in other words, knowledge about how knowledge is created, is also called epistemology, from the Greek word for true knowledge, *episteme* (ἐπιστήμη). Epistemology is necessary in order to understand conditions for the production of knowledge and how good, correct and credible knowledge is created. Within philosophy there are also the branches of ontology, which attempts to understand the nature of the world, and ethics, which has to do with the good, the right and the beautiful (the study of beauty is also called aesthetics).
A fundamental aspect of all types of teaching, research and knowledge production that takes place at universities and other higher education institutions around the world is

the understanding of how knowledge is created, how we can know that what we believe we know is actually true, and how we can best produce such credible knowledge. Over the centuries, much has been written about what should constitute scientificity and scientific knowledge. Ideas and norms regarding knowledge production have, however, changed as society, its citizens, technologies and geopolitical claims have changed. A telling example is the resistance to the idea that women should be allowed to study at university around the beginning of the 20th century. Medical scientists produced unfounded arguments that, if this were allowed to occur, women's internal genitals would shrivel and make them very unfeminine and unattractive (to men) as wives and mothers (Kaufman and Kimmel 2011). This was seen as a real threat to society. As there were hardly many women who were experts in the field, and medical experts were (and to a large degree still are) men with a large amount of social influence – and, not least, as these arguments were in keeping with the view of women that was prevalent at the time – this threw a spanner in the works with regard to the admission of women to university. Eventually, however, after half a century of pressure from the large numbers of European middle-class women who either could not or did not wish to live as kept wives, the powers that be were forced to admit women to university (Johannisson 2014; McClintock 2013). This did not, however, mean that the life of a student was easy for these women in the university world, that they easily found jobs based on their merits and qualifications, or that women's expertise was valued in the same way as men's expertise. And it still isn't, to this day.



Scientific knowledge is constantly filtered through social power relationships and valuation systems in society. Science has namely always been a question of identity (who may know) and of consensus (social agreements). Science, with its influence in society, is even described by the French philosopher and sociologist Bruno Latour as ”politics by other means”. This does not mean that scientific knowledge *cannot* be true or credible, but rather that it must always be understood as a cultural and social activity. This places a major responsibility on us, as both students and researchers.

Objectivity – a shaped way of seeing and knowing

Objectivity is strongly associated with scientificity. The history of scientific objectivity is, however, surprisingly short. After the mid-1800s, objectivity developed as a norm for how science should be practised in Europe, and with it came a set of scientific images, mappings and visualisation techniques which were gradually refined or discarded (Daston and Galison 2010). However, norms for *scientific ways of seeing and knowing* existed before 1860. For example, fidelity was such a norm (true to nature). Even *after* objectivity had taken its place on the main stage of the theory of knowledge, epistemic virtues were also developed, i.e. good and historically highly valued characteristics of real knowledge. Examples of such epistemic virtues include ”proven experience” and ”qualified assessment”, in other words, that the knowledge is fair and just, truthful, good and beneficial. As far back as the Classical Age of ancient Greece, the philosopher Socrates felt that the key to a good life was *knowledge about*

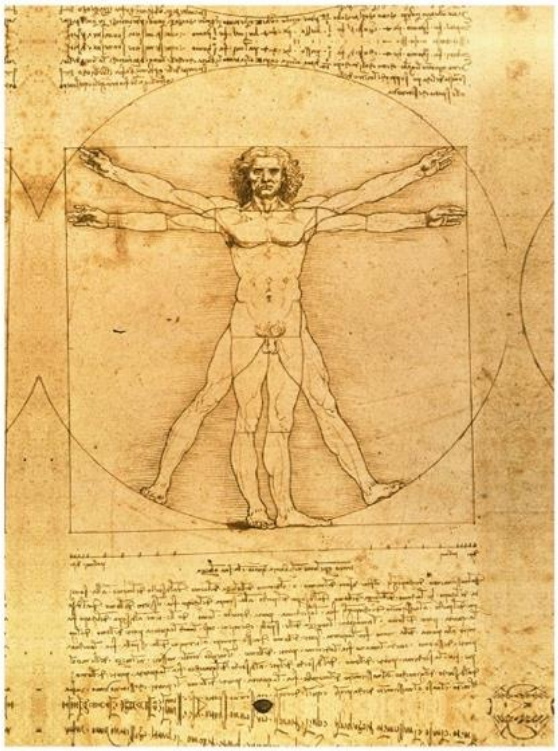
the good, and we thus received the connection between ethics (the good action) and knowledge.

If present-day scientific knowledge is to be objective, it is important *to understand what is really meant* by objectivity. This has namely changed quite a lot in Europe from the time of William of Ockham, the 14th century friar and philosopher who made his mark among the most exclusive thinkers of his day with ”Occam’s razor”, a principle for eliminating unnecessary assumptions behind a scientific method. The medieval scholars, in other words, the European clergy who dedicated themselves to studies and celibacy, felt that objectivity was that which arose in consciousness, in our minds, whereas subjectivity was the matter in itself. One could say that this is exactly *the opposite* to how we understand objectivity and subjectivity today! In other words, objectivity has not always had the same meaning throughout history. It does, however, consistently have to do with ways of seeing and ways of knowing, and with who may know and their approach. That science is associated with European men and masculinity has historical grounds that still have major effects to this day.

The science historian David Noble (1992/2013) performed an early historical study of the identity of knowledge among the scholastics, who were the first researchers who tried to organise knowledge. The scholastics were a group of monks and clergy who were part of a quite exclusive but spartan and homogeneous monastic movement consisting only of men. The members of this movement viewed women with disdain and fear, as they did not wish to be subject to the risk of breaking their vows of chastity. Noble drew the conclusion that the masculine history of science has not solely developed through the exclusion and marginalisation of women for various reasons, but rather that there was an *active hostility towards everything that women stood for* – which at the time included sexuality and witchcraft, worldliness and embodiment in general – everything that the cerebral monks despised and tried to avoid. For them, the scientific identity was naturally masculine in a manner that was almost self-sustaining, even if it took different forms of expression for different members of their movement. But it denied various men *corporeality* (embodiment) for anything other than hard work and bodily control, with the aim of fostering a higher Christian ideal and a heavenly way of thinking, without connection to the lowly world.

The researchers who were curious about the body, for example anatomists and early students of medicine, are not to be found among such clergy but rather among inventors and artists such as Leonardo da Vinci and Andreas Vesalius. These two men, each in their own way, came to shake up older anatomical knowledge by themselves performing detailed dissections and finding inaccuracies in earlier understandings of the human body. It was during the Renaissance that interest in the human body was reborn, such as in da Vinci’s rendition of the 1st century Roman architect and engineer Vitruvius’ idea that the human body’s proportions could be

used as a model of natural proportional perfection. This was, however, in reference to *men's* proportions and ways of seeing. Men were the possessors of natural proportional perfection in the ideas of this time.



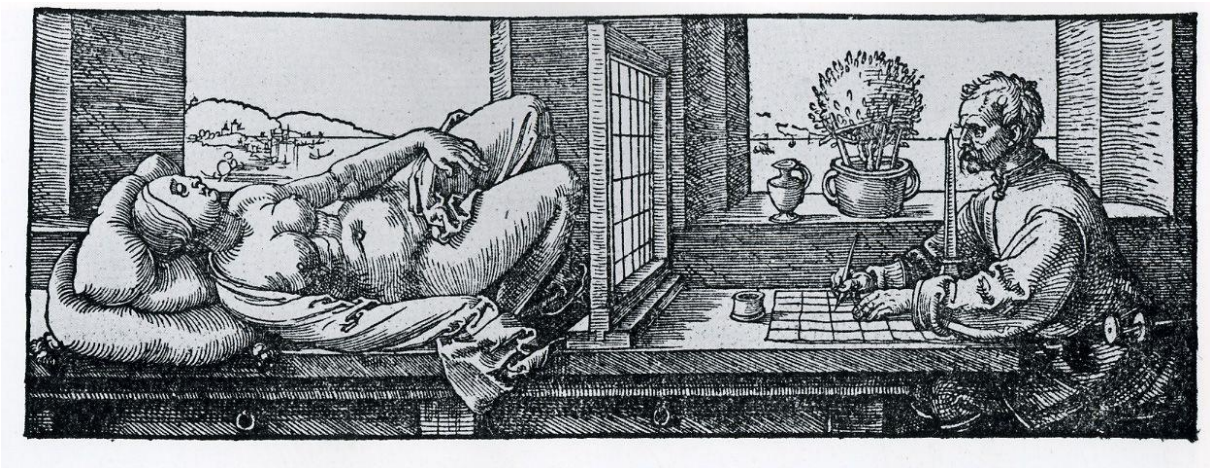
This is a vision that remains to this day in many of the ideals and values that we live with and think are completely right, even if we don't reflect over the fact that humanity consists of more than just able-bodied men of European origin. Without criticism, this vision is assumed to stand for the good deeds that science provides for humanity in general. This says something about our understanding, even to this day, of the thinking person and his gender, skin colour and Eurocentric sense and reason.

The science historian and biologist Stephen Jay Gould (1983) feels that classification systems guide our thinking and organise our human action. Science has a long history of dehumanising and objectifying Black men and women and of looking down on and exploiting women, Jews, homosexuals, prostitutes, the poor or others who don't fit into the narrow and ideologically set norm of the unfettered individual, human being and equal citizen of society. For example, medical experiments were performed on poor Black men who were allowed to live with the syphilis bacterium untreated for generations in the small town of Tuskagee. This study was only concluded as late as 1974. Much earlier, gynaecological and surgical experiments were performed on Black slave women who didn't have the right to say no (and did not own their own bodies) and (horse-dose) hormone preparations, predecessors of the modern-day contraceptive pill, were tested on poor women in developing countries without their

knowledge or consent long before they were marketed to white women. A range of other knowledge about the human body, which we still derive benefit from within medicine and healthcare today, comes from the Nazi concentration camps and Dr Mengele's experiments on prisoners. Research is not an innocent activity.

When science became science

Historically, art and science are closely intertwined in academic history, with their shared character of *acquired skills*; that is, of learning traditions, abilities and becoming really good at maintaining and mastering them (even to the point of becoming a master and teacher). For example, the development of *the central perspective* within European art (which is based on the viewer's viewing point and their channelling of what they have seen into impressions) has traditionally been linked with the idea of a neutral viewing position from which observations about a natural phenomenon can be made. This has to do with *realism as an ideal* and how impressions can be created which are referred to as reality.



Wooden engraving by Albrecht Dürer from 1538 which illustrates how the central perspective came to be an important method for lifelike renditions. Throughout European history, scientists have often been creative artists and have thus characterised and reflected their time's ways of seeing and ways of knowing. Who sees and reproduces reality, and who should be looked at in this illustration?

Technologies were developed to provide even more lifelike and, later, more objective angles of approach to that which was deemed to be true to nature. Microscopes, telescopes and, much later, photography were deemed to provide *objective* renditions of reality. These renditions were, however, biased and conditional on the recording capacity of the apparatus and the *perception of the interpreter of the image*, his or her trained eye and cultural framework (Sturken and Cartwright 2001). Objectivity has to do with the visual register of reality, what the technically mediated perspective can provide for an image. But objectivity is thus already visually shaped by technologies for viewing, a sort of visually-shaped perspective on reality and not at all what reality really is.

Science as a series of scientific approaches, even a whole way of life, came to be widely established as a specific way of seeing and knowing throughout 17th century Europe (Latour 2012). A very exact place and time for the breakthrough of the scientific method, as an approach and worldview, was a public discussion that took place in England, which at the time was severely ravaged by religious wars. The dispute stood between the natural philosophers Thomas Hobbes and Robert Boyle and had to do with the question of what *real and true knowledge* is. The experimentalist Robert Boyle, who is known as *the father of the scientific method*, emerged victorious from this debate. According to him, knowledge should be able to be described and should be *based on social agreement with others*. This is what we now refer to as *peer review*. The experimental method, which he advocated, should establish facts through social consensus and not place focus on discovering any underlying causes at all. People should instead reach agreement on how an experiment should be interpreted and what it meant. The philosopher Hobbes, on the other hand, felt that knowledge should be demonstrated together with all its causalities. He felt that knowledge derived from experiments did not lead to true knowledge at all, but rather to artificial effects based on hypothetical assumptions.

By conducting an experiment in which a bird died when the glass jar containing the bird was emptied of air with the help of an air pump, Boyle wanted to prove the existence of a vacuum. He defended himself against Hobbes' accusations that this was artificial production of knowledge without any bearing on reality by performing the experiment *publicly* with *credible witnesses*, and by showing that it could be *replicated* at any time and still produce the same result. Hobbes was sceptical about scientific instruments and this type of objectivity as they could create phenomena that don't exist in nature. He therefore questioned the legitimacy of the experimentation – did it really provide evidence of the natural processes, or just artefacts and thus a distorted form of nature? Proving the existence of a vacuum was in itself no small thing in the midst of a religious war – as God would, of course, be omnipresent.

According to the science historians Steven Shapin and Simon Schaffer, the dispute between Hobbes and Boyle had an enormous effect throughout the whole of Europe. They feel that the experimental and hypothesis-driven approach advocated by Boyle made such a big impact because it was in line with society's need for new order, coordination and consensus. The view that knowledge is most securely created by allowing it to be jointly *witnessed* and performed by trained experts, was spread to the general public via public experiments and verified through *replicated* scientific experiments that were spread via agreements and scientific societies (including royal academies of science), in publications and letters (what we now refer to as scientific articles). Studies and experiments became knowledge, *matters of fact*, after other scientists *and the wider public* had witnessed or reviewed descriptions of the experiments and had jointly agreed that this knowledge does actually represent fact.

Painting: Joseph Wright of Derby, 'An Experiment on a Bird in the Air Pump', 1768 – shows the popularity of scientific demonstrations at pubs, and how science moved from the private to the public domain. The distribution of social roles – the demonstrator and his witnesses – fascinated and credible, or aghast and not as credible – is also visible. We also see the sacrificial, non-human participant (the bird) in the production of knowledge and the pursuit of the dissemination of science in the public arena of what was known as "gentlemen scientists".

In other words, large parts of this scientific tradition and the social way of seeing how knowledge is best created remain with us to this day. Popular science, for instance, is not an afterthought but was part of science from its very early-modern inception, and still is. However, also in views on *who* may know best, and who is most free, neutral and independent in order to produce matters of fact for society. Robert Boyle felt that the researcher, naturally a well-to-do man of European origin who could employ workers as laboratory assistants to handle the instruments and devices, was exactly this sort of "*modest witness"* to the production of knowledge in practice. His privileges ensured the independence and truthful content of the knowledge. Not having research funding, technical instruments, assistants, authority and pondus in society quite simply makes the knowledge produced less credible. As pointed out by scientific theorist Donna Haraway, the *very specific subjectivity* of this European gentleman scientist became the influential *norm for scientific objectivity*.

New perspectives and approaches for more scientific science

The actual definition of a scientist has come to be synonymous with an autonomous figure who is governed by sense and reason, someone who is free from relationships of dependency, economic frameworks, emotions or physical limitations. Very few people, if anyone, can actually live up to this ideal. Most of us are not bounded individuals in splendid isolation, fully cognizant at all times and free of feelings, desires and socio-economical relationships, living a life of pure, disembodied, mind.

A long tradition of feminist scientists and knowledge theorists have drawn attention to the problems associated with this view of science (Åsberg and Lykke 2010). These problems can be summarised under four headings:

1) *Biological determinism – The criticism questions the idea that* the body we are born with should determine our place and status in society and whether women are born with greater suitability for reproductive work and taking care of others.
2) *Scientism* – The criticism questions the idea that knowledge is made most certain within the frameworks of academia and that an expert must always be a man.
3) *Disembodiment* – The criticism questions the idea that it is possible to be neutral and to separate one's body from one's thoughts and emotions. In particular, the idea that men are less corporeal, less embodied than women. We are all corporeal, even as scientific subjects (knowledgeable persons), and the question is more how we reflect over and frame this social fact.
4) *Objectification* – The criticism has questioned whether it is possible to separate the scientific person from the rest of the world and turn parts of the world into a pure object, into passive matter and resource. For women, the process of objectification has entailed exposure to sexualisation, and for non-Whites it has entailed different forms of exoticisation, primitivisation and racialisation. For that, or those, which/whom has not just simply been *dehumanised* (not granted full human subjectivity, citizenship or rights) but is in fact *not* human at all, such as animals, plants and machines, this has even entailed exploitation to the brink of extinction.

Feminist empiricism: gathering new and correcting old knowledge

Based on this set of criticisms, feminist science theorists (Longino 1993; Haraway 1997; Harding 1991; 2004) have developed other scientific practices and knowledge theories that aim to make the production of facts less dependent on social privileges and power relationships in society.

One practice is that of *feminist empiricism*, which has to do with using empirical studies to correct existing inaccurate facts, and to fill the gaps in knowledge that exist regarding women's conditions in life. This has even saved lives in that researchers have discovered, and taken seriously, previously dismissed women's diseases (for example, endometriosis, vaginismus, depression, PMS) and have also realised that men can also suffer from certain diseases that were earlier deemed to be women's diseases (for example, osteoporosis, suicidal ideation and depression). The point of departure for feminist empiricism is very similar to ordinary scientificity, in that the researcher should be neutral as an observer and should contribute to new insights, new knowledge. Feminist empiricism acts as a form of *scientific correction* and has contributed to new knowledge in a large number of different disciplines. Women's

different conditions in life throughout history have been studied, and attention has been drawn to forgotten women who have been of importance, for example, important women researchers, authors and artists. Furthermore, feminist empiricism has demonstrated the consequences of academia having been dominated by a particular category of men, and that the norm for humanity has been a specific type of man. A type that neither represents all men, nor all people, but rather a societal minority setting the unobtainable standard for all.

One recent example of feminist empiricism is the work of James Zou and Londa Schiebinger (2018) and Tannenbaum et al. (2019), who have shown that there is an algorithmic distortion as a consequence of the fact that the assumptions made by the programmers who create the algorithms are both reflected and enhanced in how the algorithms are trained and used. This algorithmic distortion leads, inter alia, to, a range of everyday effects that support and bolster social stereotypes, like digital cameras claiming that Asian people close their eyes when having their picture taken, and that facial recognition technology works least well on Black women due to such *algorithmic bias*.

Feminist standpoint theory: we are all biased, but the bias can be openly accounted for

Yet another knowledge theory alternative is that of *feminist standpoint theory*. This is based on the principle that there is *always a bias* in our production of knowledge due to the way we have been brought up and trained to see and know the world. Researchers must therefore clearly account for their standpoint in all research and make it a strength rather than a weakness of the knowledge produced. An important epistemological criterion is that of *strong objectivity*, which is based on clearly accounting for a researcher's insight that all knowledge is shaped by the individual's earlier experiences and social privileges or limitations. *A feminist perspective* is thus not concerned with a perspective that will represent all women, but rather with insights into the history of science with regard to how knowledge and power has been shaped by specific masculine norms.

Situated knowledges: views from below does not mean better knowledge, but local situation requires responsibility

Another epistemology that is related to both feminist empiricism and standpoint theory is that which is based on the science theorist Donna Haraway's thoughts regarding *situated knowledges*. This has to do with a way of seeing and knowing that is based on the principle that the creation of knowledge never takes place in a social vacuum. Rather, knowledge is always confirmed and verified *visavi* the acknowledged limitations that encircle the insight, such as previous experience, instrumentation used, academic discipline and traditions of knowledge that give shape to what is seen and known in the local situation of observation. The question of *who* produces the knowledge is therefore also of importance in this view, and not something to take for

granted. However, this does not mean that the socially subordinate person's perspective provides the best description of the greater whole (as assumed within feminist empiricism). With situated knowledges, a person zooms out and in, goes to the top of the mountain and tries to see the whole picture while also trying to see and account for (the mountain) or that which shapes our way of seeing the small details. This is a way for researchers to make themselves responsible for the knowledge that is mediated and always limited by ways of seeing.

With situated knowledges, Haraway tries to find a way of avoiding two old scientific "god tricks" – the totalising and the relativising way of seeing and being in the world. The first god trick has to do with claiming that there is a neutral position from which one can see everything and can omnipotently and justly assess everything, like God. The second god trick has to do with pretending to be able to understand everything and everyone in a tolerant manner, like God. To avoid these two god tricks, because people are not Gods, it is necessary to acknowledge that knowledge is situated, to openly and frankly account for how, and with which perspectives and privileges, one has gathered data and interpreted such data, and what one hopes to achieve with this in the light of the world's problems. This also has to do with asking oneself and accounting for, not only what one's creation of knowledge means (how it can be interpreted or represent) in a greater context, but also what effects it might entail in society. What does my research contribute to in the world? As with standpoint theorists, everyone has a social perspective of their own (or their group), but the epistemology of situated knowledges is not based on the idea that certain perspectives are better than others. It is based on the principle that *everyone* is equally involved in maintaining or changing the valuation systems that govern production of knowledge and society. For better or for worse.

Lessons to be learned

What can we, who have the responsibility and privilege of working with the production of knowledge as students and teachers, learn from this overview of how scientificity and gender have coloured each other?

- Train our awareness of the fact that we are all shaped by the conditions and normative values of our time, and that in every situation there are other ways of seeing and perceiving the world.
- Think about what the social agreements look like in the academic contexts we are part of. How are knowledges shaped and matters of fact created in consensus today? What assumptions are taken for granted, and what are the consequences of this?
- Obtain more knowledge about the history of science and technology, and different perspectives of theory of knowledge. We must allow ourselves to dive into something deeper, even if it feels a little alien or even uncomfortable. We must dare to venture outside our own comfort zone of values, theories and ways of doing things. A good activity is to create a study circle and read texts

together with others, compare readings and create a level of familiarity and trust between the members of the group. It is certainly no disadvantage if the members of the group come from different backgrounds and disciplines. Dare to create an environment in which everyone is able to ”speak their mind” and ask strange and uncomfortable questions. Together we should be curious, *welcome mistakes* and failures, open ourselves to the fact that it is human to err and that we can all be wrong at some point!

- Dare to question our own valuation systems – the systems we carry with us from home, from school, and from our friends or social media.
- With a little practice we can also learn to shift between different perspectives and to respect those who don't think as we do. Is it perhaps even possible to learn something from ”dissentient” thinking? Copernicus, Galileo, Haraway and justice activists would think so.
- We should always ask ourselves the question ”*cui bono”,* that is who stands to gain from this?” *Cui bono* (Latin for ”to whose benefit?”), so that we can envisage the consequences for different peoples, creatures and ecologies.
- We need to take the time to reflect over wholes and parts of social life, even when we are in the midst of an important experiment in the lab.
- Always remember that something which is deemed to be true and everlasting today could be viewed totally differently tomorrow – how will future generations, future historians, assess our research, classes and teaching of today? What did we contribute to, in the small details – and in relation to the greater context?

With all this in mind, we have better possibilities to meet contemporary challenges such as inequality and gender inequality, issues that put a spanner in the works of our desire and ambition to create a sustainable and democratic society. It is perhaps in the small details, in our own production of knowledge, that we can take important steps towards a more liveable planet for the many.

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