

# Gender Sensitive and Socially Responsible Philosophy of Science

Inmaculada Perdomo Reyes

University of La Laguna, San Cristóbal de La Laguna, Spain

The aim of this paper is to defend a view of the philosophy of science as a practice that should reflect not only about the disciplinary classical topics: science methodology, the practice of model construction, explanation or relations with technology. Philosophy of science should reflect also on the directions science might take and the goals sought, and ponder; as well, must include questions concerning who should make these decisions and in accordance with what procedures to promote a more inclusive and democratic science. It's an agenda that includes gender and ethical topics and a commitment with responsible research and innovation in the context of our democratic societies.

*Keywords:* philosophy of science, responsible research, gender, democratic science, women and ICT

## Science as an Inclusive and Diverse Practice

Science, directed at the achievement of collective goals, fulfils the principal aim of responding to relevant and significant questions (Kitcher, 2001; van Fraassen, 2008). But these questions are dependent upon context and decidable within the framework of democratic societies. Traditional efforts to design a notion of epistemic significance independent of contextual restrictions, free from social and moral values, and demanding that the obtaining of epistemically significant truths is valuable in principle, is an undertaking impossible: Moral and social values are inherent to scientific practice. Nor is it possible to defend the idea that all sciences can be unified in a hierarchical chain, or the vision that the integration of all theoretical proposals in a unified scheme is the essence of the objective understanding of our world. In fact, the image of a patchwork of theories, laws, and disciplines without a hierarchical order or systematic relationship defended by N. Cartwright (1999) seems a more appropriate vision of the structure of science. Philosophy of science plays the part of authorised interpreter of the scientific practices, the epistemological orientations that guide scientific procedure, and of the attitudes towards science (Perdomo, 2014). It must do that through dialogue between those involved in undertaking, and criticise the epistemic injustice and exclusions in our democratic societies, scientific practices.

Also, it has turned its attention away from the classical epistemological question: How do we know, and now focuses instead on the question of the goals and results of science: What do we know and what do we not know, and why? The basic questions now are: Who is science for? How does the fact that some people are

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Inmaculada Perdomo Reyes, Ph.D. in Philosophy of Science and Professor of the Area of Logic and Philosophy of Science, Faculty of Humanities; Director of the Research Institute of Gender and Women Studies, University of La Laguna, San Cristóbal de La Laguna, Spain.

excluded from science influence our knowledge? Which projects and goals are pursued and which ignored? Which experiences are considered valid or adequate and which are not? It is precisely these types of decisions that make up the practice of science and which, finally, define the problems deemed relevant and the type of solutions deemed acceptable. Once a problem has been defined, just one response may be the most appropriate solution, but the problem could have been defined in a different way, and perhaps even other problems may have been identified as more relevant. From this point of view, Kitcher's arguments and thoughts regarding the possibility of a *well-ordered science* and the conditions under which such a science would be possible in the heart of democratic societies are extremely suggestive.

To my mind, the question of *democratic science* is posed transversally in the reflection on science and enables us to identify three relevant areas of philosophical analysis (Perdomo, 2011, p. 133):

- a. That related to *theory contents*.
- b. That related to the *practice of science*.
- c. That related to the *goals and directions of science*.

Regarding the first point, many interesting works by feminist science critics, which focus on warning about the biases present in scientific contents, mainly in biomedical theories, share this concern (see the classical lectures Harding, 1986; Bleier, 1984; Fausto-Sterling, 2000, and others). Regarding the second, as an example, Feminist Epistemology (Potter, 2006) had explored the processes and activities of social construction of knowledge concluding that the subject is plural but women are not in the center of that process; their voices are devaluated and not authorized (Longino, 2001). It is an epistemic injustice (Fricker, 2007), and political action must be considered to increase the number of women in STEAM areas, and the structures of science and academies must be changes to create a more democratic or inclusive decision-making processes (Schiebinger, 2011).

The dynamics and gender asymmetries in career paths of women and men, and real evacuation of women from classrooms in relevant areas and professions must be also analyzed. As an example, this year we knew that Tokyo medical school altered test scores to keep women out. The university began to keep the percentage of women admitted each year to around 30% of the incoming class. This had been done since 2010 when around 40% of successful applicants were women. This is an explicit exclusion, but some other mechanisms must be observed.

Many studies have addressed the key institutional and sociological use of technologies (digital divide) and the shaping of professions: Hierarchical and territorial discrimination and the glass ceiling or leaky pipeline (classical concepts applied to the academy), the vanish box, and other mechanisms are also identified like trapdoors in the practice of the technology industry. They explain the dynamics and gender asymmetries in career paths of women and men in ICT professions.

Let's look to the special case of the "exodus", as it is termed, in the field of computing and which I define as "eviction". It is interpreted (by dominant discourses) as the result of free elections of women, who now have other preferences, tastes, and interests. The reality is that more than a half of the women working in the fields and computer professions leave pressed and forced by a male work environment, high isolation, and extreme working pressures. This loss of the number of women in the core of computing is creating a great loss not only talent but an eviction from the core of the creation of knowledge, meanings, artifacts, and representations. Technological imagination opens new and unexpected cultural and democratic possibilities, and women must not suffer from epistemic injustice.

### Case Study: The *Exodus* of Women in ICT

From the 1970s the progress of women in all professions is becoming very prominent, near 50% in many of them. However, it was not in the field of computing. Around mid-1960s women participated in the emerging industry and computer professions and in the 1980s obtained 37% of the titles and they were working in all areas where information technology was innovative. At the end of the 1980s they constituted 38% of the workforce (white collar) in the US. It was really, a success for the profession and for women's movement, being a very attractive career field for them. The perception was that these jobs were more akin, pleasant, and innovative done in scientific laboratories or engineering offices.

Despite these early successes, something unprecedented in the history of professions hit computing in the mid-1980s: not merely did women stop entering computing in large numbers, but the proportion of women studying computing actually began falling—and it has continued to fall, steadily, all the way through to the present. No other professional field has ever experienced such a decline in the proportion of women in its ranks. (Misa, 2010, p. 5)

A trend is also produced in the European context: A low percentage of women is involved in the professional practices of the technology industry. Harvard Business Review published in 2008 (Hewlett, Luce, & Servon, 2008) a report on women in science, engineering, and technology and showed that: Between 25 and 30 years the percentage of women with training and qualifications in these areas was 41%, but 52% of this talent are expelled from the professional field, being the main cause sexism that permeates these contexts. New publications in Harvard Business Review in 2014, 2016 almost reached the same conclusions, considering that up to 50% of women working in science, technology, and engineering depart from STEM due to hostile work environments. Women perceive that the technology industry is promoting a toxic environment for women, and a high percentage has experienced sexual harassment, micro-aggressions, feelings of vulnerability, discomfort, which makes decide to open the trapdoor and go away.

In 2011, in the US, less than 12% of graduates in computer science were women, although this trend began to be corrected, because of the programs implemented and greater support to students. Currently the percentage of women in the classroom is 19% on average in the OECD. Their presence in the industry and other professions also falls considerably in recent decades. The “exodus” as some qualifies and which I define as “eviction” is interpreted by those as the result of free elections of women who now have other preferences, tastes, and interests.

Remedios Zafra (2013, p. 39) points out one reason for this situation that is the fact that in the 1990s a change of name of the studies as the result of the reform at the University, occurs, and that was not innocuous: A bachelor of computing was renamed as “computer engineering” and this acted as a “switch”. Professional expectations became different to those that must choose; engineering came symbolically associated in our culture to a kind of masculine practices, which did not happen to the bachelor. Words are not harmless, or classifications, when they generate expectations, attractive or not, and induce the election. In this case, new students do not opt for the new studies, even when only the name has changed.

So, more than a half of the women working in the fields and computer professions leave (retire) pressed and forced by a male work environment (*macho work environments*) as told for professionals involved, also: high isolation, extreme working, and pressures. This decrease in the number of women at the core of computing is creating a great loss just in the current space of the creation of meanings, artifacts, and representations of our current techno-culture.

When and why did this gendered culture emerge in the field of computer industry? Ellen Spertus, in 1991, when he was a young graduate of MIT, wrote an article entitled: “Why Are There So Few Women Computers?” The problem, in her opinion, was not so much formal discrimination or explicit barriers to women, but rather the gender bias encoded in the professional culture. Spertus introduced an anecdote: In his introduction to the course of robotics professor made the following joke: “soon we can have robots sophisticated enough to roam the malls and pick up girls” (Misa, 2010, p. 7). The students who reported the episode do not remember the content of the rest of the class and they transmitted that these comments put them in a position of disavowal as future professionals, placed them in a sexual condition, and made them feel they were in the computer rooms only as guests.

Further analysis shows that very different professional expectations separate the 1960s and 1980s and the industry changed significantly from large installations based on a huge, central computer to the profusion and revolution of the personal computer. Also, keep in mind the great diversity of experiences of women in computing profession: working as programmers and systems analysts with high salaries, but mostly at lower levels as operators, digitizing and maintenance of equipment. The exclusion of the highest positions and marginalization due to the dynamics: job feminization-masculinization of professions, also observed in other professions.

But more than any other factor, the representations of culture define gender identities, roles, and spaces that should occupy men and women in our societies, and the computer industry reflect also this situation. The emergence of male nerds in popular culture, the emergence of the powerful gaming industry (now billionaire) clearly aimed at boys and massive incorporation of classic stereotypes in their stories and images along with the proliferation of the male image in the media associated with the transformative power and innovative technology and computers, have clearly contributed to the creation of a dominant discourse that links masculinity, technology, and power, contributing to the generation of imagery and a very powerful symbolic universe that also defines and shapes the authorized subject of these practices.

The same culture produces a dominant discourse that explains the low participation of women in computer science education and low interest in computers with the argument that we are different (essentially different) and that men and women have therefore different attitudes towards computers. It is assumed that:

Men have an exploratory and playful attitude while women are guided only by necessity, not by enthusiasm or curiosity.

Men become addicted and love the technology itself, while women wonder what for they can use.

Men are interested in the sophisticated technique and women just in communication.

They also have different skills; women better understand the situation of use and men tend to get lost in the exciting details. (Corneliussen, 2010, pp. 175-176)

The change in the dominant discourses, practices and values in the design process and the education system should be the key to redefine traditional gender relationships with technology. The aim must be to achieve better industry ICT education and culture. Practices, agency users (prosumer) and designers must now take center stage to promote technological and cultural change, and women should participate in that process. New approaches speak of socio-technical design perspective on the new user of ICT that is the community and participate in the creative and cultural process shaping means participating in the design of a common better

and more equitable future. And the design in HCI (Human Computer Interaction) calls for rethinking the philosophy and values of technological design, considering the multiple identities and interests of human beings, forgetting the pattern of a universal user. Some programs such as “Girls in ICT” promoted by the European Commission, or “Girls Who Code”, are initiatives to be optimistic because they stimulate and educate the younger for this necessary change of culture and mentality. The programs are aimed at the increased presence of women in all areas, especially STEM and ICT but that does not avoid incorporating the same dominant views and values and making dominant discourses as theirs.

The challenge, therefore, is not only bringing more women, or excluded groups to science and technology, but to gain insight into how meanings of new science and technologies are structured, reproduced, recreated and conform our world. The goal is to be able to participate on an equal condition and consciously in the act of designing ethically and socially responsible techno-culture (Balsamo, 2011). Scientific policies should pursue the *common good* and philosophy of science can offer a valuable help.

### **Epistemic Injustices**

Miranda Fricker’s concepts (hermeneutical and testimonial injustices) explain these mechanisms of exclusion well, reaching the area of epistemology and ethics. Epistemic activity evaluated, not in ideal and abstract terms, but considered that it is carried out by socially situated individuals, in the highly relevant context of shaping our current techno-culture such as in education, profession, and institutions. Inequalities and power issues associated with market dynamics form a highly competitive world displacing subjects defined as different, i.e., women and others.

There are two basic epistemic practices that we need to consider to address Miranda Fricker’s proposal: first, to transmit knowledge to others and secondly, to make sense of our own social experiences. Both types of epistemic practices involve social and discursive interactions so these interactions must be situated in the field of policies and ethics of epistemic practices. These mechanisms or types of *epistemic injustice* are at the root of the dynamics of exclusion of women from the center of shaping our current techno-culture, which produces, transmits, and reiterates narratives of “authorized” subjects, and make those of different subjects invisible. The myths and images that structure our visions of technology continue to transmit the image of men as authorized agents of scientific and technological development, and women as subjects are not interested in it, or not as much capable as men.

Furthermore, in a clear reference to Helen Longino criteria for criticism in scientific communities, when members of certain groups are taken less seriously in the classroom, in the lab, at conference venues, and in the grant proposal process, one effect can be that the researcher does not receive the level of rigorous criticism that might be required to strengthen their work or help them identify in what positive direction the work needs to be developed. This is too a participatory injustice, argues Grasswick (2017).

In the case of science, the significance of such participatory epistemic injustices is exacerbated because of the high degree of cognitive authority placed in the institutions of science. When society relies on and privileges the institutions of science to direct and produce knowledge that will have social relevance, the impact of participatory epistemic injustices that prevent or deter access to these communities of knowledge generation is more pronounced than in other areas of knowledge production (Grasswick, 2017, p. 317).

### Science Directions and Goals: A Role for the Philosophy of Science

And finally, in relation to third point, Kitcher's analysis of democratic decision-making processes applied to science suggests several interesting dilemmas which may be posed in response to the questions: How should we decide democratically which research areas and projects should be funded? What goals should science obtain? What projects would contribute to the common good if put into practice? Firstly, what do we mean by "the common good": that which is beneficial to the citizens of modern, rich, western democracies or the ones that will benefit all humanity? This debate is plagued with dilemmas but the question of how we should make decisions about science in today's modern, democratic societies is closely linked to yet another question: How can we democratise decision-making processes in science?

The relevant question here is that the agents involved in this type of discussion are not only scientists; moreover, the decisions made only by scientists do not result in a *well-ordered science*, since the pressures of competitiveness may prompt them not to consider the interests of other individuals, most human beings. In fact, it is precisely this overlooking of the interests of the clear majority of human beings that constitutes the starting point for the need of a *well-ordered science*. In that sense, the question: "What kinds of science should be done?" is crucial (Kitcher, 2011).

Scientific policies play a key role in the establishment of the goals and objectives, which science should strive to achieve. This is now a big problem for all the countries because of the risks associated to the climate change and the advances of Biotechnologies and promises of Transhumanism, and worries about the Posthumanist new era (Braidotti, 2013). Funding projects, establishing priority areas of research, making a commitment to applied or basic research, and laying out selective research quality evaluation and assessment criteria, etc., are all ways in which science aims to achieve certain goals. This orientation necessarily involves the ignoring of other possible lines of action which may have otherwise been initiated or developed. In democratic contexts, scientific policies should pursue the *common good*. This notion becomes a central one, and as such, it also becomes a critical task of the philosophy of science, in all its plural trends, to warn of any "failures to comply with" or "deviations from" the main objective, namely, that of improving the living conditions of all human beings taking care of the all living beings and of our common house.

Philosophy of science must deliver also an important social function: making the public more aware of the importance of science, promoting a critical and informed public opinion. Philosophers of science could be considered as public intellectuals who speak up for science and technology, and rectify common misconceptions or uninformed judgments that may feed into political lobbies, agendas, and ultimately policy-making. Philosophy of science is an integral part of our public discourse on science. Recent public discourses of P. Kitcher or M. Massimi emphasize our responsibility to communicate the value of science and technology to society at large. We need much more ethically, gender sensitive and politically informed philosophy of science. Many general questions about the proper role of science in democratic societies and with respect to human lives have yet to be adequately addressed (Kitcher, 2018). Integrate gender dimensions and other philosophical tools in all research and innovation to avoid epistemic injustices and epistemic ignorance are crucial tasks for a socially responsible philosophy of science.

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