COMMENTARY

Analyzing data is one thing, interpreting it another

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Most professional scientists, engineers, and mathematicians today are men. The reasons for this are partly historical. Until recently, women were in many countries not admitted to or were discouraged from pursuing higher education. For much of the Western world, this situation changed dramatically in the 20th century, a change more recently followed by active measures to recruit more women into scientific disciplines and to fight gender stereotypes.

These are certainly welcome changes that work towards the democratic goal of equal opportunities. But they have brought us into a situation in which we do not know how much of the still existing gender imbalance in science and related disciplines is legacy, how much is choice, and how much is due to the remaining biases and stereotypes that prevail in our societies—and in our minds.

One way to react to this current situation is simply to demand that scientific professions reflect the demographic distribution of society by large, which means that the fraction of women and underrepresented ethnic groups needs to increase. Actions to support this goal are based on political value decisions, but they should be guided by sound scientific evidence, for otherwise we cannot tell if they even work towards our goals. It is here that Alessandro Strumia's recent study becomes relevant.

Strumia analyzes the scientific literature in parts of physics, primarily particle physics, astrophysics, and cosmology. In these disciplines, about 80% of the practitioners are presently men. In his work, Strumia identifies the gender of authors by matching names to publicly available lists of common first names. Then he sets out to quantify differences between genders in terms of hiring age, citations, and paper productivity.

Strumia's major finding is that, on average, women write fewer papers than men, their papers are less cited than those written by men, and they are hired with lower bibliometric indicators based on these measures. His findings are significant and robust. My collaborators Tobias Mistele, Tom Price, and I have been able to reproduce the bibliometric results with the same database and with a different database of the same disciplines.

One could now debate how relevant the quantifiers used by Strumia are, in particular when it comes to the way in which he defines "gender asymmetry" in citations, but that would be missing the point. Strumia's analysis collects biographic and bibliometric data from about 70,000 scientists and is therefore statistically far more informative than most of the existing studies on gender bias in physics and related disciplines, which recruit on the order of 50 or so participants. Regardless of whether one thinks that Strumia's specific bibliometric measures capture the essence of what it means to do good science, they provide us with a wealth of insights about gender differences and, to a lesser extent, country differences (though in the latter case the statistical uncertainties are necessarily larger).

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Studies such as Strumia's, of course, cannot reveal the origin of the existing gender differences, and the question of what measures of scientific impact are useful is a loaded one, even leaving aside gender. Still, works such as his allow us to understand better what the current situation is and what impact our policies have had, if any. It seems likely that in the coming years we will see similar bibliometric studies in other disciplines. Maybe the most surprising thing about Strumia's analysis is that it wasn't done sooner.

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