Artículos

https://doi.org/10.34024/prometeica.2025.32.19515

NEUROFEMINISM AS EPISTEMOLOGICAL GUERRILLA

NEUROFEMINISMO COMO GUERRILLA EPISTEMOLÓGICA

NEUROFEMINISMO COMO GUERRILHA EPISTEMOLÓGICA

Sonia Reverter Bañón
(Universitat Jaume I, Spain)
reverter@uji.es

Recibido: 18/09/2024
Aprobado: 15/12/2024

RESUMO

No sistema científico, persiste a crença de que a diferença sexual é uma qualidade essencial, ou seja, uma essência natural. Este postulado sustenta que o cérebro é atualmente o órgão mais adequado para investigar essa essência. O avanço da neurociência, juntamente com o desenvolvimento das tecnologias de neuroimagem e o investimento significativo na investigação do cérebro desde o final do século XX, gerou grandes expetativas na comunidade científica e no público em geral relativamente às perspectivas da investigação neurocientífica. Isso pode, por vezes, impedir o apropriado avanço e consolidação do conhecimento. Uma infinidade de grupos científicos, laboratórios, universidades, centros de investigação, empresas privadas, grandes grupos editoriais e plataformas editoriais estão envolvidos numa corrida para decifrar o grande enigma do cérebro humano. A diferença sexual é um dos prémios mais cobiçados nesta busca. Vários membros da comunidade científica, de diversas disciplinas e perspetivas, alertaram para estes perigos potenciais. Neste artigo, defendo uma epistemologia crítica que promova um diálogo vigilante e contínuo contra o essencialismo da diferença sexual. A isto chamo "guerra de guerrilha epistemológica". Neste artigo, apresento o exemplo do que se tem chamado "neurofeminismo" como guerrilha epistemológica. O objetivo deste trabalho é problematizar criticamente um conjunto de pesquisas científicas no campo das neurociências através deste exemplo.

Palavras-chave: diferenças sexuais. neurofeminismo. epistemologia feminista. vigilância do conhecimento. guerrilha epistemológica.

ABSTRACT

The scientific establishment maintains a persistent belief that postulates the existence of sexual difference as an essential quality, that is, as a natural essence. This postulate further asserts that the brain is the most appropriate organ for investigating this essence. The advancement of neuroscience, coupled with the advent of neuroimaging technologies and the significant investment in brain research since the late 20th century, has generated considerable expectations in the scientific community and the general public regarding the prospects for neuroscientific research. Such circumstances may, on occasion, impede the

appropriate advancement and consolidation of knowledge. A considerable number of scientific groups, laboratories, universities, research centres, private companies, large publishing groups and publishing platforms are engaged in an endeavour to unravel the great enigma of the human brain. The pursuit of sexual difference is one of the most sought-after objectives in this field of study. A number of scientists from various backgrounds have cautioned against the potential pitfalls of this approach. In this paper, I propose a critical epistemology that employs a vigilant and ongoing dialogue against the essentialism of sexual difference. I refer to this as epistemological guerrilla warfare. In this article, I present the example of neurofeminism as an instance of epistemological guerrilla warfare. The aim of this paper is to undertake a critical examination of a body of scientific research in the field of neuroscience through the use of this specific example.

Keywords: sexual differences. neurofeminism. feminist epistemology. knowledge surveillance. guerrilla epistemology.

RESUMEN

Hay una creencia pertinaz en el sistema científico que postula la existencia de la diferencia sexual como una cualidad esencial, es decir, como una esencia natural. Este postulado mantiene, a su vez, que el cerebro es actualmente el órgano más adecuado para investigar esta esencia. El avance de la neurociencia, unido al advenimiento de las tecnologías de neuroimagen y a la importante inversión en investigación del cerebro desde finales del siglo XX, ha generado una considerable expectación en la comunidad científica y en el público en general respecto a las perspectivas de la investigación neurocientífica. Esto puede, en ocasiones, impedir el adecuado avance y consolidación de los conocimientos. Multitud de grupos científicos, laboratorios, universidades, centros de investigación, empresas privadas, grandes grupos editoriales y plataformas de publicación están inmersos en una carrera por descifrar el gran enigma del cerebro humano. Y la diferencia sexual es uno de los premios más codiciados en esta persecución. Varios miembros de la comunidad científica, representantes de diversas disciplinas y perspectivas, han advertido contra estos peligros potenciales. En este escrito abogo por una epistemología crítica que emplee un diálogo vigilante y continuo contra un esencialismo de la diferencia sexual. Me refiero a esto como guerrilla epistemológica». En este artículo presento el ejemplo del llamado neurofeminismo como guerrilla epistemológica. El objetivo de este trabajo es problematizar críticamente a través de este ejemplo un conjunto de investigaciones científicas en el campo de las neurociencias.

Palabras clave: diferencia sexual. neurofeminismo. epistemología feminista. vigilancia del conocimiento. guerrilla epistemológica.

Introducción

The history of science and knowledge has for decades supported prejudices and lies. Most of these lies are aimed at maintaining a patriarchal ideology that tenaciously endeavors to update the idea that men are superior to women. This vice is constantly criticized by feminist epistemology and has been upheld by many theories throughout the history of science (García Dauder and Pérez Sedeño, 2018). These pseudoscientific theories support a belief that, though shaped in various ways by the different disciplines, has turned out to be quite stony, constant and as well as solid. I am referring to the belief which holds that sexual difference exists and is essential — that is, it obeys a natural essence.

With the success of neuroscience and the interest in brain research shown by several large projects, the brain appears to be the best candidate to inquire into that essence. Thanks to the development of neuroscience, of neuroimage technologies, and the money that has been invested in brain research since the late 20th century, great expectations have been raised around neuroscientific research among both,

the scientific community and the general public. This may at times go against a proper development and consolidation of knowledge. Scientific groups, laboratories, universities, research centers, private companies, large publishing groups and publishing platforms, they are all racing to unravel the enigma of the human brain (Littlefield and Johnson, 2012). And sexual difference is one of the most coveted trophies in this race. A part of the scientific community has red-flagged these risks from different disciplines and sensibilities (Rippon, 2019; Jordan-Young, 2010; Eliot, 2011)

But, are the contributions of neuroscience sufficiently solid so as to keep talking about differences between the brains of women and men? What is scientific evidence telling us? Is science corroborating the widespread belief that the brains of women and men, as distinct groups, are different? There is no doubt that science today should be able to provide us with fully-guaranteed answers to these questions, for much of our present and future depends on this scientific knowledge in many ways.

In this paper, I propose to carry out a brief exercise of critical epistemology, highlighting the importance of surveillance in the work of science, considering the significant private interests that may contaminate it (Rose, 2006; Rose and Abi-Rached, 2013). This is demonstrated through a concrete example of epistemic surveillance. This is the work of the Neurogenderings Network group, a collective of female scientists engaged in brain research. All the members have expressed concern regarding the lack of rigour evident in some conclusions pertaining to sexual difference. I refer to this work as 'epistemological guerrilla' and consider it an illuminating example of the necessity for epistemic deconstruction. My intention is to contribute to the scientific community's epistemic vigilance, which is essential for the advancement of knowledge free from prejudices.

The concept of Epistemological guerrilla

This work of surveillance and permanent dialogue is what I have termed ‘epistemological guerrilla’ (Reverter, 2017, 2022). The concept of guerrilla typically refers to a form of irregular warfare that relies on small, mobile groups that use surprise attacks, ambushes, and hit-and-run tactics. Guerrilla warfare focuses on agility, local knowledge, and the support of local populations rather than direct confrontation. The term guerrilla warfare has been a prominent strategy in various liberation movements, revolutions, and civil conflicts.

Some characteristics of the use I give here to the concept of epistemological guerrilla are the following:

1. Collective identity: The emphasis of a guerrilla movement is not on the individual, but rather on collective identity. This enabled members of the guerrilla network to concentrate on the message rather than individual identities, thereby emphasising the collective aspect of their activism.

2-Science as activism: members of a guerrilla network employed the utilisation of surveillance and denouncement as instruments for the advancement of social transformation. Such endeavours are not merely driven by the desire to gain knowledge about the world; rather, they are underpinned by an ethical imperative.

3-Influence and legacy: The objective of a guerrilla movement is to inspire other movements and to persist in challenging institutional biases. In recent years, their activities have broadened to encompass issues such as the underrepresentation of the LGBTQ+ community, economic inequality, and broader social justice concerns within the scientific domain. They facilitated the illumination of the inequities that pervade the scientific domain. Their work provides an illustrative case study of how science can be deployed as a vehicle for activism.

The inspiration for this concept comes from the guerrilla work carried out by those of us who are dedicated to feminist theory and practice — the work of rescuing voices, of bringing attention to theories and thoughts as well as that of dismantling disciplinary canons, thought structures, systems that organize knowledge according to principles that only regard one type of experience, a tightly-defined way of

reasoning and feeling. All this encompasses the epistemological work of 'departriarchalizing' the world. And this, shocking as it may sound, we must also do it in the field of modern neuroscience.

The scientific knowledge about the sexual difference in the brain

But, how can science lie to us if this contravenes its very own principles? Mostly to answer this question, I began my research on what is called 'neurosexism.' I have devoted many years of my work as a university professor to understanding and explaining the structure of a system of oppression that creates, sustains, organizes, adapts and readapts structures of inequality between women and men. I offer a theoretical reflection informed by critical and philosophical considerations. And, from this philosophical perspective, questions are linked to other questions: why is there inequality in thinking? Why is there inequality in wages? Why is there inequality in careers? Why is there inequality in household roles? Why is there inequality in the surveillance of bodies? Why is there inequality in democratic institutions? Questions on top of more questions. And it seems that these unanswered questions also reach that which appeared to be less contaminated by prejudice — biological scientific knowledge. More precisely, our most recent scientific knowledge, 21st century knowledge, created in laboratories and research institutions funded with public money. Is this science also sexist like, as Laqueur (2003) tells us, was most of the research on sexual difference conducted during the 19th century and the first half of the 20th century? And the answer is yes, there is science today, bad science, that is being conducted with the motivation of strengthening prejudice regarding gender rather than reaching a sound understanding of bodies and minds.

My reflection here does not only intend to evince how biased scientific knowledge is as to the question of sexual difference in the brain – an issue about which interesting articles are being published –, but also the reach of patriarchy as a system of power that organizes life and its meanings, as well as the knowledge of the world. In other words, science, as well as bad science, legitimized as good science, has huge effects on our small daily lives as well as on the big planetary decisions. That is why it is paramount to review this constantly. Without this vigilance, this epistemological guerrilla, as I call it, the consequences for our lives, for life in general, can be catastrophic. Let's not forget that even rights are partly gained according to a political, social and cultural consensus that often borrows from the scientific rhetoric as the basis to validate such rights.

The misrepresentations of scientific evidence have been particularly detrimental and unjust to women. These misrepresentations have been employed not only to justify the differences between women and men but also to perpetuate inequality (Fine, 2010; Jordan-Young, 2010). It is imperative to acknowledge this. Any sexual difference that may be substantiated, irrespective of its nature, cannot inherently imply inequality between the sexes (Schmitz, 2012).

The fact that the research conducted on sexual difference, which today is particularly focused on the brain, is being used to justify and legitimize inequality between women and men, clearly indicates the patriarchal interests around (and sometimes inside) some scientific research. In other words, there is a remarkable epistemological leap from pointing out differences to affirming inequalities. Such leap has been customarily utilized by any scientific discipline deriving from the prejudice of human inequality, be it between genders, races, sexualities, ethnic groups or any other groups (Roy, 2018).

Brain research has been promoted by governments and institutions and massively funded since the 1990s. It brought the question of the human brain into the open. This event facilitated the task of airing experiments and scientific theories on the sexual difference in the brain. Such sexual difference in the brain became denaturalized. At the same time, increased rigor was demanded from research on this matter. However, this coincided with a revolution in scientific communication through powerful publishing platforms, new ways of scientific validation, and the massive use of social media to disseminate science (Maney, 2016). All this has had a significant disruptive effect on the way knowledge is produced and disseminated. As some studies indicate (Baum and Coen, 2019), inequality patterns are being dangerously repeated in both, scientific production and publishing and communication. Gender

bias is not only found in scientific review processes (Helmer et al., 2017) and publishing processes (Rippon et al., 2014, Rippon et al., 2017). According to the latest studies (European Commission, 2021), scientific literature has declined in terms of replication standards and equality (Squazzoni et al., 2021). This has become more apparent since the pandemic.

On the bright side, we can highlight the benefits that massive open dissemination of knowledge may bring if we activate such ideas as 'open science' or 'citizen science' (Vohland et al., 2019). In a way, scientific data is telling us that the glass is half empty but also half full. Depending on how we interpret this and what scientific policies we support and carry out, we will see one horizon or the other. In other words, we have a problem, but we also have a solution. Scientific knowledge, its openness and public scrutiny, will allow us to get rid of biased patterns in the production and communication of knowledge.

As regards the topic in question, it is precisely this openness and the possibility for such scrutiny that has brought a conversation around the idea of 'neurosexism' in relation to human brain research. 'Neurosexism' is a recently coined term. As I will explain later, it basically refers to the sexism that is present in neuroscientific research when studying brain differences between both sexes. The world-famous book *Men Are from Mars, Women Are from Venus* (Gray, 1992) would represent a crass example, but an example after all, of how sexism in science is eventually spread through the popularization of the scientific theses that we are witnessing in the last decades[1]. In their thirst for shocking theories to feed mass communication, scientific publishing platforms may release scientific studies that are conducted with negligence, lack of scientific rigor, or even false data, as long as they have a scientific and social impact that can be summed up in a headline like "Scientists affirm that women talk more than men." This is a real case of a study carried out with ten girls and ten boys (Brizendine, 2006)[2]. Indeed, this "scientific" research only required 20 subjects to answer, with a certain irony, one of the biggest questions of society: Do women talk more? There are hundreds of cases like this and, during the last decade, many works have been published to see whether there is any truth at all in any of these theories and experiments[3].

Recent high-profile scientific works such as the ones published by neuroscientists as Anne Fausto-Sterling (2019), Gina Rippon (2019), Lise Eliot (2021) or Daphna Joel and Luba Vikhanski (2019) show us that the reason why science so stubbornly pretends to demonstrate that men and women have two different brains since they belong to two different groups, is due to prejudice, malpractice, and untruthful outcomes from experiments. These untruthful results on sexual difference also present an appeal to the media which immediately turn them into headlines that are massively consumed by society, perpetuating the idea that "we are different."

Neurogenderings Network as an example of Epistemological Guerrilla

In the field of neuroscience, an epistemological guerrilla has been organized by the collective Neurogenderings Network (NGN). This group is mainly made up of female scientists who are focused on reviewing and criticizing this pseudoscience of the sexual difference in the brain. This project was born within the academia and with the idea of organizing themselves as a group, since they were individually facing neuroscientific debates where "something was wrong," to put it in plain words. The NGN project was born in the first decade of the 21st century, right when neuroscientific projects and new techniques to observe and measure the brain were quickly developing thanks to the large investments pouring into brain research.

[1] Another example of great popularity has been the works of the neuroscientist Brizendine (*The Female Brain*, 2006; *The Male Brain*, 2010).

[2] The question thus arises as to what the scientific basis for this claim may be. Brizendine was asked the same question by phonetician Mark Liberman (2006), who sought to identify the sources of this conclusion but was unable to do so. Brizendine subsequently acknowledged her mistake and was obliged to remove the figures from later editions of her book. As Liberman (2006) himself reports in his blog, what he did find are studies showing that there is no sex difference in language proficiency. Despite this major error of underrepresentation in the sample of the experiment, it reached the media with headlines like these: "The cause for female verbosity" (ABC, 02/22/2013), or "Female brain" (El País, 1/28/2007).

[3] Many examples of these theories can be found in Fine's book (2010).

Neurogenderings Network originated at a conference organized by the Center for Gender Research at Uppsala University in 2010, entitled NeuroGenderings: Critical Studies of the Sexed Brain. This gathering was followed by five more conferences (Vienna 2012, Lausanne 2014, New York 2016, Leiden 2020, Online 2022) motivated by the same interest of separating scientific brain research from the pseudoscience of sexual difference of the brain. This group gathers specialists in such disciplines as neuroscience, humanities, philosophy, social science, cultural studies, medicine, chemistry, psychology, biology, gender and queer studies, feminist theory, and science and technology studies. Their research covers a wide scope of topics related to the field of sex/gender and the brain, assessing the current state of neuroscientific research, its methods, findings and conclusions, representations and interpretations. Their aim is to start a dialogue through the different disciplines to develop richer and more detailed neuroscientific proposals than those that are commonly presented in this field. Their goal is to offer more reflective concepts and discussions to better guide the dialogue between neuroscience and social and educational interests (something which this network calls 'neuropedagogy').

The term 'neurosexism' is a neologism that precisely gathers all those positions and theories that neuroscientific research employs to reinforce predetermined ideas about inherent differences between sexes. The term was coined by the psychologist Cordelia Fine, founding member of NGN, in a 2008 article. However, it became popular thanks to her 2010 book *Delusions of Gender: How Our Minds, Society, and Neurosexism Create Difference*. By this term, Fine refers to sexist, acritical and unscientific stances that are based on a dominant patriarchal ideology and that pretend to demonstrate that the brains of women and men are different just for being women and men. Another neologism appears along with 'neurosexism' — 'neurofeminism.' The latter actually refers to the critical response to the former. 'Neurofeminism' aims at a critical revision of scientific theories in order to reveal how much ideology and how much science is actually to be found in the theories on brain sexual difference.

As Fine observes (2008), the starting point is the determination that the hypotheses on differences between the male and female brains are based on low-quality false outcomes, poor methodologies, unproven suppositions, and premature conclusions. On top of this, an insufficiency is observed in the study of the depth and reach of cultural patterns, beliefs and expectations in our minds. We can affirm that, in a broad sense, neuroscientific research today may be contaminated by the prejudices that guide it.

In the ongoing surveillance effort that the Neurogenderings Network carries out as a collective and also on the Internet, it has published several academic and informative articles, written jointly and separately by its different authors, pointing out the profound scientific errors committed by the neuroscientific research on sexual differences which have a broad impact on the lives of people. Therefore, the issue is not only scientific, so far as it concerns the search of the truth. Science, and whatever it validates, also has an ethical and social influence on our lives and on the course of human and nonhuman life on the planet.

The core arguments where they have found support are mainly based on the criticism of fundamental beliefs at the base of scientific brain research on sexual difference. Let us go for a brief review of these critical arguments.

The first and broadest one, as it involves other prejudices, is the permanent confusion between sex and gender. Using one or the other indifferently or indistinctly blurs and disarrays the possibility of clarifying when and how we use one concept and when and how we use the other. Despite the constant clarifications from the academia and the departments of feminist and gender studies, we find that neuroscientific literature mixes them up and uses one or the other invariably as synonyms. This confusion is indeed relevant in studies that attempt to reveal sexual differences between women and men. In other words, these are studies that analyze a sample that has been divided according to gender in order to measure sex differences. This is no minor confusion, as it indicates a conceptual unawareness that ignores the social and political reach that the conclusions of such studies might have (Jordan-Young, 2010). In addition, when they mistake these concepts by using them as synonyms, they usually evince

the fact that the conclusion at which they are aiming is the one from which they depart; namely, that women and men are different both in gender and sex, since the latter determines the former.

Kaiser (2012) brings attention to the fact that this terminological indecision may evince a deeper uncertainty as regards the way in which the origin of the differences between men are women is observed and explained. As Schmitz (2012) observes, this means that there is a lack of confidence and/or agreement concerning the question of whether the behavioral differences between men and women may be attributed to the sex of the brain or whether, on the contrary, these differences in the brain may be explained from the differences in behavior.

The second argument of epistemological criticism is the perpetual insufficiency of evidence and the prejudice that lead to these conclusions. As certain renowned opinions on this matter have pointed out (Vidal, 2011; Jordan-Young, 2010), which some studies using metadata have confirmed (Hyde, 2005, 2006, 2007), the so-called scientific evidence presented until now does not scientifically conclude that sexual differences are found in the brain, and that sexual orientation and gender identity are defined in the early stages of fetal development due to the hormonal circuit and genetic and chromosomal definition. As Jordan Young (2010) explains in her exhaustive study, such hormonal process of sexual definition has not been proven to have defining implications in the structure and functionality of the brain. On the contrary, the critical reviews of findings that affirm neuronal differences in female and male brains based on the aforesaid hormonal circuit generally lack rigor and are conducted in an unscientific fashion.

The argument that NGN neuroscientists and scientists bring forth is that the differences found in the brain of women and men do not prove to be a determinant when it comes to differentiating cognition. There are indeed differences between the brains of men and women, but these do not confirm or support any determinism in cognition or behavior to talk about "a sexual difference in the brain of two different groups of human brains — women and men."

In addition, the lack of evidence is connected to the poor design of some of the experiments and tests. As NGN scientists criticize, it is common to reach very impacting conclusions from small samples. Let us consider how the neurologist Brizendine (2006) claims, according to the difference in the number of spoken words, that women are better prepared for communication, empathy and the perception of emotions, whereas men, on the other hand, are better prepared for action and rational thinking. However, evidence is clear on this matter. As the neurologist Catherine Vidal (2011) affirms, when the number of analyzed subjects is large, sex differences normally disappear due to the ample interindividual variability of the brain.

Lack of evidence is also linked to the fact that people normally work in artificial lab settings. As our authors criticize – and this is the third relevant argument –, the findings in these settings are hardly possible to transfer to real-life experiences of the material world. This problem is easily perceived in experiments conducted with a scanner. As NGN neurologists criticize (Rippon, 2019), the data provided by the fMRI only shows a static image of a specific state of an individual's brain. It provides no direct evidence of biological factors or sociocultural processes that may have had an influence on such state. To observe sexual differences in the structure or function of the brain does not mean that these differences exist at birth neither are they recorded throughout life (Schulman, 2013). As Bluhm (2011, 2013) warns in her analyses of gender stereotypes in neuroimaging research on emotion, the conclusions of many experiments on differences between men and women using brain scans are a self-fulfilling prophecy.

Fourthly, they criticize that, despite the scientific evidence, some theories play down neuroplasticity. The NGN group believes that neuroplasticity will become more relevant in the study of brain differences not just as a hypothesis, but as a major fact (Fine et al., 2013). The fundamental contribution of this concept is the idea that the human brain is not 'wired' in set neuronal circuits. This thesis holds, on the contrary, that many examples exist of cortical and subcortical changes in neuronal circuits as a response to training or brain damage. Neurogenesis – the birth of brain cells – is considered more and more as

evidence. It takes place in the brain of mammals in adult life and such changes can happen throughout life (Rakic, 2002). The neuroplasticity thesis gives us a significant scientific base as regards sexual difference, also allowing research on ways to enhance education, schooling and training to prepare brains to make better individuals and societies possible — fairer, more equal and freer. As the neurophilosophy of Churchland (1986) would tell us, it is not so much about investigating the brain to see what we can expect of it, what it tells us, and how it explains our human behaviors, but to reach a consensus on the values and practices that we need to train so our brain activates those regions that allow us to model more significant individuals and experiences for a more humane future.

Since the organization of the human nervous system is a dynamic ongoing process, in a functional organizational sense, it is understood that our experience depends on that plasticity (Fine et al., 2013). The question is about organizing a set of ethical and social values and an educational system that can influence that plasticity and benefit from it in line with the values and aptitudes that we choose as the most humane.

The plasticity thesis supports the idea that our brain keeps on transforming itself with our experiences throughout our lifetime. Thus, the differences that we find in the brain between individuals (regardless of the sex) are higher than the differences that we find between sexes, due to their individual transformations through experience. Meta-analysis studies conducted by Hyde (2005, 2006, 2007) demonstrate that a review of 46 meta-analyses sustains the hypothesis of brain similarity with regard to sex/gender. This author concludes that the sex/gender differences may substantially vary in magnitude in the different ages of a person and depending on the context where the measurements are taken. If we consider that 90% of the neuronal connections take place after birth (Rakic, 2002), it is reasonable to think that such connections ought to be related to experience and learning throughout life.

The plasticity concept gives us a perspective of biology that transcends the neurogenetic determinism that suggests that structure precedes function. As the neurologist Catherine Vidal claims (2011, p.3): “Plasticity challenges the old dichotomies of nature and nurture by showing that the phenomena of human existence and experience are simultaneously biological and social”.

Owing to all this, and according to the critical review work of the NGN group, we can affirm that it is mostly gender stereotypes that maintain cultural differences between men and women through education at all levels, socialization, and social pressure; and, consequently, due to brain plasticity, these differences may be modeling and differentiating neuronal responses. For this reason, in order to assess individual differences within the richness afforded by the plastic and transforming capacity of the brain, we must free ourselves from gender stereotypes and cultural roles that patriarchal societies strongly maintain, even today.

Conclusions

These simple contributions that we have just seen – shaped as informed criticism of four frequent errors detected in neuroscientific research on sexual difference – are an example of the epistemological guerrilla exercised by the Neurogenderings Network group. Furthermore, they show the necessity to maintain and foster an epistemological surveillance in science. As regards the sexual difference issue, this surveillance is helping to demand better science and to disarm constant and repeated prejudices in the field of neuroscience.

Needless to say, all the disciplines are reluctant to change the principles that rule them. And sexual difference (and inequality) is a ruling principle in all the knowledge — in everything. That is the way we must understand today the sentence that the third president of NOW (New Opportunities for Women) and nursing professor, Wilma Scott Heide, pronounced in the 1970s, “All knowledge is suspicious.” The biologist Fausto-Sterling also said this in her acclaimed 1986 book, *Myths of Gender. Biological Theories about Women and Men*: “In the study of gender (like sexuality and race) it is inherently impossible for any individual to do unbiased research” (1986, p.10).

Suspicion is precisely the best start for knowledge. It is not easy to organize this surveillance, this epistemological guerrilla that I propose herein, especially if it goes against powerful interests or prejudices that have been established for centuries. The case of sexual difference in the brain provokes both, interests and prejudices. However, scientists know that both can and must be brought down by science, good science. For this reason, the epistemological guerrilla is more necessary than ever.

The objective of this study is to demonstrate the necessity of vigilance, denunciation, and critical reflection as a means of ensuring the integrity and veracity of scientific knowledge. In light of the perpetuation of prejudices under the guise of scientific knowledge, it is imperative that the scientific community itself be equipped with the capacity to validate knowledge. This will necessitate the formation of epistemic communities that continue to prioritise the value of truth and a commitment to justice above all else. In light of the pressing challenges currently facing our planet, it is imperative that an epistemic revolution be pursued on a daily basis, within every scientific community, group and laboratory, to ensure the continued vigilance necessary to safeguard knowledge from the influence of prejudice. The strategy outlined in this paper, which I have termed "epistemological guerrilla," represents a crucial aspect of this endeavour.

References

Baum, B. & Coen, E. (2019). Evolution or revolution? Changing the way science is published and communicated. *PLoS Biol,* 17(6), 1-5. Available at https://doi.org/10.1371/journal.pbio.3000272

Bluhm, R. (2011). New research, old problems: Methodological and ethical issues in fMRI research examining sex/Gender differences in emotion processing. *Neuroethics,* 6(2), 319-330. Available at https://doi.10.1007/s12152-011-9143-3

Bluhm, R. (2013). Self-Fulfilling Prophecies: The Influence of Gender Stereotypes on Functional Neuroimaging Research on Emotion. *Hypatia,* 28(4), 870-886. Available at https://doi.org/10.1111/j.1527-2001.2012.01311.x

Brizendine, L. (2006). *The Female Brain*. New York, USA: Broadway Books, Random House.

Brizendine, L. (2010). *The Male Brain*. New York, USA: Broadway Books, Random House.

Churchland, P. S. (1986). *Neurophilosophy: toward a unified science of the mind-brain*. Cambridge, USA: MIT Press. Bradford Books.

Eliot, L. (2011). The trouble with sex differences. *Neuron*, 72(6): 895-898. Available at https://doi.10.1016/j.neuron.2011.12.001

Eliot, L. (2021). You don't have a male or female brain – the more brains scientists study, the weaker the evidence for sex differences. *The Conversation.* (22 April 2021). Available at https://theconversation.com/you-dont-have-a-male-or-female-brain-the-more-brains-scientists-study-the-weaker-the-evidence-for-sex-differences-158005

European Commission, Directorate-General for Research and Innovation. (2021). *She figures 2021. Gender in research and innovation. Statistics and indicators.* Publications Office, 2021. Available at https://data.europa.eu/doi/10.2777/06090

Fausto-Sterling, A. (1986). *Myths of Gender. Biological Theories about Women and Men*. New York, USA: Basic Books.

Fausto-Sterling, A. (2019). Gender/Sex, Sexual Orientation, and Identity Are in the Body: How Did They Get There? *Annual Review of Sex Research*, Special Issue, 56(4-5), 529-555. Available at https://doi.10.1080/00224499.2019.1581883Fine, C. (2008). Will working mothers' brains explode? The

popular new genre of neurosexism. *Neuroethics,* 1(1), 69-72. Available at https://link.springer.com/article/10.1007/s12152-007-9004-2

Fine, C. (2010). *Delusions of Gender: How Our Minds, Society, and Neurosexism Create Difference*. New York, USA: W. W. Norton.

Fine, C., Jordan-Young, R., Kaiser, A. & Rippon, G. (2013). Plasticity, plasticity, plasticity and the rigid problem of sex. *Trends in Cognitive Sciences,* 17(11), 550–551. Available at https://doi.10.1016/j.tics.2013.08.010

García Dauder, S. & Pérez Sedeño, E. (2017). *Las 'mentiras' científicas sobre las mujeres*. Madrid, España: Los libros de la Catarata.

Gray, J. (1992). *Men Are from Mars, Women Are from Venus*. Harper Collins Publishers

Helmer, M., Schottdorf, M., Neef, A. & Battaglia, D. (2017). Gender bias in scholarly peer review. *Elife,* 2017(6), 1-18. Available at https://doi.10.7554/eLife.21718

Hyde, J. S. (2005). The Gender Similarities Hypothesis. *American Psychologist,* 60(6), 581–592. Available at https://doi.10.1037/0003-066X.60.6.581

Hyde, J. S. (2006). Gender Similarities Still Rule. *American Psychologist,* 61(6), 641-642. Available at: https://doi.org/10.1037/0003-066X.61.6.641b

Hyde, J. S. (2007). New Directions in the Study of Gender Similarities and Differences. *Current Directions in Psychological Science,* 16(5), 259-263. Available at https://doi.org/10.1111/j.1467-8721.2007.00516.x

Joel, D. & Vikhanski, L. (2019). *Mosaic brain: beyond the myth of the male and female brain.* New York, USA: Hachette Book Group.

Jordan-Young, R. M. (2010). *Brain Storm: The Flaws in the Science of Sex Differences*. Cambridge, USA: Harvard University Press.

Kaiser, A. (2012). Re-Conceptualizing ''Sex'' and ''Gender'' in the Human Brain. *Zeitschrift fur Psychologie,* 220(2), 130–136. Available at https://doi.org/10.1027/2151-2604/a000104

Laqueur, T. (1990). *Making Sex: Body and Gender From the Greeks to Freud*. Harvard University Press.
Liberman, M. (2006). Language Log. Personal professor's Blog. http://itre.cis.upenn.edu/~myl/languagelog/archives/003419.html

Littlefield, M. & Johnson, J. eds. (2012). *Neuroscientific Turn: Transdisciplinarity in the Age of the Brain*. Ann Arbor. The University of Michigan Press.

Maney, D. (2016). Perils and pitfalls of reporting sex differences. *Philosophical Transactions B.* The Royal Society Publishing, 371(1688), 2016 371 20150119. Available at https://doi.10.1098/rstb.2015.0119

Rakic, P. (2002). Neurogenesis in adult primate neocortex: an evaluation of the evidence. *Nature Reviews Neuroscience,* 3(1), 65–71. Available at https://doi.10.1038/nrn700

Reverter, S. (2017). El neurofeminismo frente a la investigación sobre la diferencia sexual. Daimon. *Revista Internacional de Filosofía*, 2017(6), 95–110. Available at https://doi.org/10.6018/daimon/291561

Reverter, S. (2022). *La diferencia sexual en el cerebro. Una revisión crítica desde el feminismo*. Granada, España: Comares.

Rippon, G. (2019). *The Gendered Brain: The New Neuroscience that Shatters the Myth of the Female Brain.* London, UK: Bodley Head.

Rippon, G., Jordan-Young, R., Kaiser, A. & Fine, C. (2014). Recommendations for sex/gender neuroimaging research: key principles and implications for research design, analysis, and interpretation. *Frontiers in Human Neurosciences,* 8(650), 1-13. Available at https://doi.10.3389/fnhum.2014.00650

Rippon, G., Jordan-Young, R., Kaiser, A., Joel, D. & Fine, C. (2017). Journal of neuroscience research policy on addressing sex as a biological variable: Comments, clarifications, and elaborations. *Journal of Neuroscience Research*, 95(7), 1357-1359. Available at https://doi.org/10.1002/jnr.24045

Rose, N. (2006). *The Politics of Life Itself: Biomedicine, Power, and Subjectivity in the Twenty-First Century*. Princeton, USA: Princeton University Press.

Rose, N. & Abi-Rached, J. M. (2013). *Neuro: The New Brain Sciences and the Management of the Mind*. Princeton, USA: Princeton University Press.

Roy, D. (2018). *Molecular Feminisms. Biology, Becomings, and Life in the Lab*. University of Washington Press

Schmitz, S. (2012). The neurotechnological cerebral subject: Persistence of implicit and explicit gender norms in a network of change. *Neuroethics,* 5(3), 261-274. Available at https://doi.10.1007/s12152-011-9129-1

Schulman, R. G. (2013). *Brain Imaging: What it Can (and Cannot Tell us About Consciousness*. New York, USA: Oxford University Press.

Squazzoni, F., Bravo, G., Grimaldo, F., García-Costa, D., Farjam, M. & Mehmani, B. (2021). Gender gap in journal submissions and peer review during the first wave of the COVID-19 pandemic. A study on 2329 Elsevier journals. *PLoS ONE,* 16(10), 1-17. Available at https://doi.10.1371/journal.pone.0257919

Vidal, C. (2011). The Sexed Brain: Between Science and Ideology. *Neuroethics,* 5(3), 295-303. Available at https://doi.10.1007/s12152-011-9121-9

Vohland, K., Weißpflug, M. & Pettibone, L. (2019). Citizen Science and the Neoliberal Transformation of Science – an Ambivalent Relationship. *Citizen Science: Theory and Practice,* 4(1), 1-9. Available at https://doi.org/10.5334/cstp.186