



Women and the Sciences: A Feminist Poststructuralist Analysis of the Marquise du Châtelet's

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Abstract

In the 1730s, there were many doubts about the nature of heat and fire. In view of this, the Academy of Sciences in Paris proposed a prize for the dissertation that brought a solution to this issue. In a context in which women's education was directed solely at the domestic sphere, Marquise Émilie du Châtelet submitted her Dissertation on the nature and propagation of Fire and overcame the obstacles that limited women's participation in Science. Academia managed to prevent her physical presence, but her name and her ideas transcended the barriers of the Enlightenment and the determinist thought of that period, and she became a recognized, published and recommended woman. In this work, we present this character and an analysis of her work on Fire. In order to do so, this research relied mostly on bibliographical information, which implied the search and analysis of primary, secondary and tertiary sources for the study of Du Châtelet's Dissertation. For the analysis of primary and secondary sources, we relied on a poststructuralist feminist perspective for the understanding of the marquise's role in her time. In this way, in a poststructuralist feminist reading, the marquise is an example that there are no biological, structural and temporal limits that justify the ideological barriers used to essentially support the participation of women in scientific fields. The fact of being a woman was decisive for her historiographic erasure, denouncing a deliberate choice made by men during centuries of exclusion and silencing of women.

Keywords: women and science, Émilie du Châtelet, nature of fire

Mulheres e Ciências: Uma Análise Pós-Estruturalista Feminista da Marquesa du Châtelet

Resumo

Na década de 1730 pairavam várias dúvidas sobre a natureza do calor e do fogo. Em vista disso, a Academia de Ciências de Paris propôs um prêmio para a dissertação que trouxesse uma solução. Num contexto em que a educação das mulheres era direcionada unicamente à esfera doméstica, a marquesa Émilie du Châtelet inscreve sua *Dissertação sobre a natureza e a propagação do Fogo* e supera os obstáculos que limitam a participação das mulheres nas Ciências. Conseguiram impedir sua presença física na Academia, porém seu nome e suas ideias transcenderam as barreiras do pensamento iluminista e determinista daquele período, tornando-se uma mulher reconhecida, publicada e recomendada. Neste trabalho apresentamos essa personagem e uma análise de seu trabalho sobre o Fogo. Para isso, a pesquisa foi majoritariamente de cunho bibliográfico, implicando a busca e análise de fontes primárias, secundárias e terciárias, nos baseamos na perspectiva feminista pós-estruturalista para a compreensão do papel da marquesa em sua época; e na análise de fontes primárias e secundárias para o estudo da *Dissertação*. Desta forma, numa leitura feminista pós-estruturalista a marquesa é um exemplo de que não existem limites biológicos, estruturais e temporais que justifiquem as barreiras ideológicas utilizadas para fundamentar essencialmente a participação das mulheres nas áreas científicas. O fato de ser mulher foi decisivo para seu apagamento historiográfico, denunciando uma escolha deliberadamente feita por homens durante séculos de exclusão e silenciamento das mulheres.

Palavras-chave: mulheres e ciências, Émilie du Châtelet, natureza do fogo

Introduction

The notorious female under-representation in scientific fields is related to the predominance of an ideology that continues to support the neutral and objective view of science, as discussed by Haraway (1995). The impossibility or inability of rational argumentation and the fragile nature of women are characteristics that were historically and culturally attributed to them, hindering their participation in science. This separation became evident with the distinction between the public and private spheres in a gradual process over several centuries. With the increasing professionalization of science, scientists needed domestic support to advance their careers, leaving women's activities restricted to the private sphere (Schiebinger, 1993). In this regard, it should be noted that there are two factors to be overcome: the historical heritage and the belief that women are biologically inferior to men and, consequently, are naturally and exclusively guided by their emotions, making it impossible for them to use reason.

However, it is important to note that historiographical studies involving women and even other cultures only began to be reviewed in the second half of the 20th century. Therefore, if only the names of male scholars are the most cited, it is not due to the fact that they were the only ones who participated in the construction of scientific knowledge, but rather to the fact that they were organized and disseminated in another context of the historiography of science (Olesko, 2003; Doel & Söderqvist, 2006, p. 5). In an environment such as that produced from the 18th-century Enlightenment, when academic societies were already well-established, could it be that only men were interested in and contributed to Natural Philosophy?

In this sense, we explore in this text a historical narrative through a poststructuralist feminist perspective centered on the episode in which Émilie du Châtelet¹ (1706–1749) developed the Dissertation on the nature and propagation of fire², discussing conceptual, metaphysical and philosophical aspects. The Dissertation was written by the Marquise and submitted to the Academy of Sciences in Paris to compete for the prize offered to the work that best explained the nature of fire, which she did anonymously since women were not allowed to participate in the Academy, much less in academic competitions.

Throughout the Dissertation, as will be discussed, The Marquise uses experiments, analogies, her knowledge of Leibniz's metaphysics and Newtonian optics. She quotes several natural philosophers, alchemists and argues in a logical and coherent way, showing that she is inserted in the philosophical discussions of her time and has knowledge that surpasses her role as a noble woman.

Compared to the works of other natural philosophers of her time who were already widely publicized, the Dissertation does not fail in terms of methodology, arguments, justification and examples. Therefore, knowing and disseminating the exquisite work

1 Throughout the text, we refer to Émilie du Châtelet as: the Marquise, Du Châtelet or Émilie, staying true to the references used. Our preference, however, is Émilie, since we understand that this was how she liked to call herself, nicknaming her philosopher friends "Emilians".

2 *Dissertation sur la nature et la propagation du Feu* is its original title and we will refer to it in the body of the text as the Dissertation.

of an 18th-century woman and her contributions to natural philosophy is the duty of an inclusive and diverse historiography, which is capable of expanding and producing new approaches, doing justice to those who contributed to the construction of scientific knowledge and were erased by the traditional historiography of the sciences.

This is a part of the history of the sciences that has been ignored and some researchers have raised hypotheses for this, among which is the fact that the Marquise was a woman (Pereira & Silva, 2021). At times, and when rarely mentioned, she is simply introduced as Newton's translator and/or Voltaire's lover (Iltis, 1977; Martins, 2022). We developed a historical narrative from a poststructuralist feminist perspective of the sciences, seeking to rebuild the mistaken image that we found of this character that was influenced by the traditional historiography of the sciences. Poststructuralist feminism presents itself as a political movement that denies the essentialism of the feminine nature attributed to women who (like our character) dare not accept the roles assigned to them even before their birth (Code, 2002).

These clashes are present in everyday school life and absent from formal curricula (at least in a precise and clear way). Teacher training is the initial target for such debates to be included in basic education (Paraíso, 1997; Carvalho & Rabay, 2015; Felipe & França, 2018; Gonçalves & Quirino, 2017). Knowing the Marquise's story in a narrative that emphasizes the conflicting gender relations that she experienced allows us to reflect on current convictions about the role of women in the sciences, on how this was and is built throughout history, which can broaden and direct our view to critical reflections on political and cultural stances.

In recent decades, the Teaching of Sciences has reviewed its role as responsible for attributing value to things. Or rather, we understand that, like Education in general, the training of future teachers and students for the exercise of citizenship is also part of Science Teaching. And citizenship implies, in this sense, respect for differences, social justice, the reduction of social inequalities, etc., (Oliveira & Queiroz, 2016; Oliveira & Salgado, 2020; Pinhão & Martins, 2016; Westheimer & Kahne, 2004).

Thus, this study presents itself as potentially significant material for teacher education, as it is a study on Gender and Science that is in line with current research in the area not only in Brazil, but also in Latin America (Marin & Mosquera, 2022). We discuss the perspective that guided us in choosing our character, the Marquise du Châtelet, and the treatment of the tracked historical documents; we present the Marquise, her context and the scenario in which her Dissertation is inserted; we analyze her work regarding its methodological, philosophical and conceptual aspects; and finally, we make some concluding remarks.

Women, History and Science

To discuss women in science, one should not think of them in isolation; beyond their context, it is necessary to understand their particularities and how they relate to the people around them, seeking a better and more comprehensive view of their lives

and works and, in particular, those related to the sciences. It is the perspective of men that portrays women, as well as history in general. Faced with centuries of exclusion of women in more specialized education in the sciences, we have little time in this endeavor and much to review. Historiography is undoubtedly a powerful ally and, in a reference to Orwell (1989, p. 40), “who controls the past, controls the present, and who controls the present, controls the future”. If the intention is to bring a different perspective from the one structured by centuries of exclusion of vulnerable groups, in the case of women, a poststructuralist reading seems to us the most appropriate.

In a poststructuralist reading of Butler (2017, pp. 9–10), guided by a Foucaultian view, vulnerability lies in the position the subject is in, outside the sphere of power and deprived of the ability to act. Power is beyond the idea of subjugating or ordering. Butler considers that it is something broader since power imposes itself on us, weakens us through force, making us internalize and accept its terms, and we only accept it because our existence depends on it. Thus, all social relations are of power in spaces of negotiation, confrontation and resistance. In short, one is vulnerable to ensure survival, this is a factor that is inseparable from the possibility of resistance, which is the opposite of this vulnerability.

Expressions such as “be deconstructed”, “he/she is not that deconstructed yet”, “I am deconstructing myself”³ are attributed to situations and people whose behavior somehow goes against poststructuralist feminist political and social critiques, but not exclusively. With this, we do not imply that the poststructuralist feminists played the main role in the deconstruction of the image of women, by reviewing past mistakes and thus becoming a kind of heroines (Hemmings, 2009). An important issue to be considered is in relation to the readings we did of the academic texts used in this research, which always questioned the message they brought, whom they interested and whom they privileged. Since encyclopedias (Code, 2002; Edgar & Sedgwick, 2003; Honderich, 1995) and other authors (Câmara, 1967; Costa, 2000; Mariano, 2005; Peters, 2000; Scott, 1989) who were used to understand poststructuralism do not present a definition that is closed and free of subjectivity, we tried to establish our own reading as a basis for the analysis of the Marquise’s historical case study. Poststructuralism, with which we converse, presents itself as a means of questioning the ideological barriers that were built through authoritarian discourses. This paper discusses ideas defended by some of the main poststructuralist authors (Judith Butler, Joan Scott, Londa Schiebinger, Michel Foucault and Jacques Derrida). In this sense, we present the aspects that helped us in the characterization of the necessary elements for a historical narrative under this perspective.

3 The three aforementioned expressions are literal translations of the Portuguese originals “seja desconstruído”, “ele/ela ainda não é tão desconstruído assim”, “estou me desconstruindo”, respectively. These expressions are used in Brazil.

Correlating Poststructuralism, Gender and Feminism

Poststructuralism emerges as a strong critique of structuralism, mainly in relation to the essentialist determinism connected to its ideas, such as those of Saussure. Poststructuralism is a way of reading the world, characterizing and describing it. The term has its origins in the United States, and “poststructuralist theory” is based on assimilating the work of a wide range of theorists. Making this term a reductionism, poststructuralism is a movement of thoughts, there is no definition of a methodological set, a theory or even a school. Poststructuralism is closer to a complex network of thoughts that provides diverse critical and interdisciplinary practices within different branches (Peters, 2000).

The key issues in poststructuralist theory⁴ are meaning, subjectivity, and power, although not all theorists are concerned with the three. Poststructuralist thinking questions the idea that meaning is a transparent reflection of the world and, parallel to this, Code (2002) points out that for Saussure⁵, language constructs meanings through differentiation⁶. Contrasting this claim, poststructuralists claim that the meaning of a particular signifier is not fixed in the sign; it is, however, plural and mutable, governed by the Derridean concept of difference⁷. This fact marks a distancing from the Enlightenment idea that it is possible to describe the world accurately, in addition to opening up meaning to political struggles of great interest to feminist causes, as well as marginalized groups in society.

Poststructuralists transformed the theory of meaning and fundamental assumptions about knowledge, subjectivity, and power. Feminists who follow these ideas have developed critiques that identify the absence of women and the feminine in Western thinking (Code, 2002) as a deliberate choice made by men during centuries of exclusion and silencing of women. Poststructuralist thinking, in a Derridean reading,

4 We do not intend to present a genealogical study of the foundations of poststructuralist thinking, but to present some points that justify a historical narrative that contributes to contesting distorted ideas and views about women in science.

5 Ferdinand Saussure's thoughts were the link that united the structuralists, through affirming that the forms of culture, the systems of beliefs and the discourses can be better understood by drawing an analogy with language, or with the properties manifested in language through its eminent structures of sound and meaning (Honderich, 1995).

6 The concept of difference here is reinforced by the polarized binarism of opposites, which understands a woman as the opposite of a man, if it is not a man it is a woman and vice versa.

7 In the problem raised by Derrida, difference constructs an affirming identity to the detriment of a negation (by affirming one thing, one is at the same time denying another). His observations contribute to studying and questioning policies that marginalize groups (which deny the model of affirmation) favoring others (which follow the idealized model). An example is the discussion about family rights: families that do not fit heteronormative rules end up without the rights to the goods left by a dead family member. There are cases of people coming together to form a large family, in which the roles of “mother” and “father” are shared, not defined. Our laws and public policies need to be broader and include these families, just as a plural science is essential, a space to be open to all. The ideas presented by Derrida (1973), in his *grammatology*, defend a deconstruction, not as a revolution against the idealized models, but that there is an opening to other ways of reading the world, in addition to the one that is widely defended. As Code (2002) states “Knowledge must be judged not by reference to the assertion of truth, but by its effects in the world”.

shows that the great narratives are problematic, excluding and far from the perspective of the oppressed. This same thinking, in a Foucaultian reading, denounces the same issues in terms of power relations experienced between the sexes.

The recovery of the history of women, as well as of marginalized groups in the historiography of science, contributes to overcoming a structuralist essentialist view of scientific knowledge and goes against the traditional guarantees of meaning, such as religion, Science and nature, and the great narratives that are guided by a patriarchal androcentric view of the scientific activity (Code, 2002).

We highlight the importance of overcoming the idea of naturalness and essentialism as a response to the relations of domination we experience. The barriers that are raised from these unfair relationships that are anchored in a “natural biological foundation”, prevent subjugated groups from establishing themselves in positions of command and power. The poststructuralist critiques question the discourse of Science, as well as influence the cultural studies of Science, arguing against determinism and essentialism, which underlie hierarchies and subordinations (Mariano, 2005).

Understanding how the concept of gender is configured in the poststructuralist perspective is not an easy task, and the feeling we have when we read it is of something changing, there is no single definition and application, which is why we insist on this delimitation. This is an argument in favor of the concept of gender being used as a category of historical analysis through the ideas defended by Scott (1989)⁸. In order to expand and question the role of women, in a political sphere, we need to extend our historical-cultural knowledge. The historiographic view under a feminist poststructuralist perspective of science contributes to overcoming gender prejudices, which use historical elements as arguments, making one believe that narratives are neutral and immutably true.

An Entangled Marquise

Under the adopted perspective, it is impossible to distinguish the Marquise and her works on natural philosophy from their context. Although the periodic and chronological division of history is, in a way, artificial, it is useful to understand which aspects stand out in order to intertwine society, culture and science. Our character, Émilie du Châtelet, is in a period of history characterized by Enlightenment thinking, and therefore her research, methodology and philosophy are unique to this movement in France at the beginning of the 18th century. To better understand Émilie, it is necessary to comprehend the whole scenario in which she finds herself and her influences.

When we analyze the poststructuralist feminist critiques in reference to the exclusionary culture of science, we understand the role played by science in accepting various ideological barriers. Louro (2003) points out that these critiques are directed at an idealized model based on a male and sexist view in which women were marginalized.

⁸ Scott (1989) associates criticism of binarism and essentialism with the hierarchy constructions based on Western philosophical traditions between male universes and female specificities. Gender is constructed in modern society, that is, in the labor market, in education, in the political system, there is no limitation to power relations and their representations in culture.

The studied and defended philosophical theories are based on local Western discussions and argue that our view of the sciences is directly influenced by our conceptions, forged in historically, philosophically and socially constructed preconceptions (Góes, 2019). This leads us to seek narratives that contribute to a broader and more representative view. Through those who were neglected by traditional historiography, we always question the reason for this deliberate deletion.

It is with the lenses of poststructuralist thinking that we present our character. This approach sought historical elements that were closer to Émilie's subjectivity, in an attempt to portray her by herself, a challenge in the face of what has been done so far. The Marquise is a woman who was not intimidated by biological determinism or religious beliefs, who fought for what she loved most, her studies. Before knowing her story, we could be led to believe that there were no active women in Natural Philosophy in the 18th century; thus, it is important that her story be told. In order to overcome structuralist, determinist and essentialist thinking, it is necessary to rescue the stories of so many other people who were also erased by traditional historiography.

Enlightenment Scenario

The Enlightenment presents itself as a political-social movement originated through the crises of traditional values, which spread across Europe in a non-homogeneous way (Araújo, 2019; Goodman, 1994; Jacob, 2003). The elements that are central to the Enlightenment are political and social criticism with a call for action, that is, even rich in theorization, practice was always present through the use of reason. A man should not be isolated in his environment, alienated from the world and the issues that surrounded him (Chartier, 1997). One way that Enlightenment philosophers found to be aware of social demands was by attending the Salons⁹, which served as a space to socialize and debate ideas in different ways, such as the use of theater plays and singing (Araújo, 2019; Andrade, 2011; Martins, 2022).

Another predominant element was the idea that Nature is perfect and should govern any and all human actions guided by the use of reason. Natural philosophy studies Nature and mankind; scientific work is anchored in the search for an explanation of the nature of things. This way of thinking led the Academies to offer prizes to those who explained the nature of phenomena, such as the nature of fire (Silva et al., 2013). The focus of the quest for knowledge was on understanding Nature and Mankind; and in this search the emphasis is on the use of reason, taking into account experiments and mathematics.

The quest to understand how Nature behaves was a remarkable trait even in the 17th century since nature brings stability and order, hallmarks in Enlightenment discourses (Burke, 2003). In this context, men were also objects of reflection and, through

⁹ Enlightenment philosophers used to frequent salons, environments to discuss and promote their works, always accompanied by salonnières (Burke, 2003). For some thinkers of the time, such as the philosopher Jean-Jacques Rousseau (1712-1778), this environment was not suitable for women. Despite criticism, many grew intellectually through the interactions experienced in the salons (Araújo, 2019; Martins, 2007).

liberal humanism, men endowed with a natural characteristic, which differentiated them from animals for using reason, defended freedom and equality among themselves (Araújo, 2019). What men were these? I tell you, white men.

It is in this scenario that our character Émilie du Châtelet is inserted: unable to attend universities, since it was a space restricted to men, she achieved prominence through relationships with natural philosophers in a daring way for a woman of her time, which enabled her to build her own thinking and an autonomous participation in debates. The women of the high aristocracy interacted with scholars, limiting themselves to simple apprentices and merely supporting men (Burke, 2003; Piva & Tamizari, 2012). Her participation revokes this limit imposed on women and brings new meanings to the female figure, bringing into question the essentialist and determinist arguments for the role of women in society.

Émilie du Châtelet (1706–1749): Summary of Her Works and Trajectory

The Marquise du Châtelet was born Gabrielle Émilie Le Tonnelier de Breteuil, in Paris on December 17, 1706, the daughter of Baron Louis Nicolas le Tonnelier and Gabriele Anne de Froullay, Baroness of Breteuil. She married, for convenience, marquis Florent-Claude de Châtelet Lomont in 1725, they had three children, a girl and two boys, and her second son died a year and six months after his birth. Émilie belonged to a privileged caste, ignored most of the prohibitions that fell on women even in the following century, and during her childhood she already showed an interest in studying. Her father liked to receive scholars in his house and Émile always showed avid enthusiasm (Pereira & Silva, 2021).

During her marriage, she enjoyed an apparent freedom that allowed her to have romances and dedicate herself to the study of mathematics and natural philosophy. Freedom in this period was something highly valued and discussed through Enlightenment thinking, even the Enlightenment considerably limiting it on the roles of women regarding the social context. Women who experienced popular culture were even more subjugated to the moral norms of the church, their domestic activities in the aristocratic palaces¹⁰ were carried out in the shadows, they were not allowed to be seen, there were specific corridors for the transit of employees (Roche, 2004). The context of our character was different, Émilie knew how to use the freedom that her aristocratic position granted her. She wisely played the game of the court and achieved a mutually beneficial marriage. Marriages for convenience were a common practice, in which the woman and man expanded their influence and power at court. As soon as her marital obligations were fulfilled, ensuring the propagation of the family legacy with their children, her husband left to take part in the war and advance his military career. For Émilie, all that was left was to seek a purpose in life (Badinter, 2003; Bodanis, 2012).

¹⁰ It is worth mentioning that there were several castles in this period in France, such as the castle of Cirey, where Émilie and Voltaire lived for years.

The women in her circle were inclined towards a life of pleasure through consumption, luxuries and intrigues (preferably amorous ones). Émilie considered women's conversations tedious, and in a letter she writes venting: "If I were the king, I would guarantee women all human rights¹¹, especially those involving our reason. It is because of their lack of education [that] they seem to have been born to deceive" (Bodanis, 2012, pp. 58–59). The level of education of women was very low, the vast majority of French women could not sign their own name (Dalmarco, 2013). The daughters of Louis XV left the convents illiterate. The rare exceptions, such as Émilie, were practically unknown (Batinder, 2003, p. 65). It was not a favorable scenario to her.

Émilie had ambitions that, due to her life context, she would probably not be able to achieve alone, such as her studies (something that she stubbornly yearned for throughout her journey). Her life takes a turn at the age of 22, when she meets a man who is highly sought after by women, the Duke of Richelieu (Louis-François Armand du Plessis), ten years older than her. Her father, during his last days of life, directly contributed to this feat, and Émilie did not waste the opportunity, captivating and getting involved with him, becoming his lover¹² (Bodanis, 2012).

It seems to us that the people of the Marquise's class often used their intimate relations to gain prestige in the aristocratic environment. It was a common form of negotiation; religious rules were only applied when they were in public or official royal events; in private, however, these practices were generally carried out and well-regarded. This privilege did not extend to ordinary citizens who were obliged to live under the rule of the church and the king (Roche, 2004). Émilie soon realized that, even though he was a man of great prestige, the marquis would not serve as a means of access to her so desired studies. Her relationship with Richelieu was a gateway to new adventures, and the end of this relationship was friendly and resulted in a good friendship (Bodanis, 2012).

Later on, she met François-Marie Arouet, known as Voltaire (1694–1778), and they became lovers. Even though they are from different classes, to Émilie, Voltaire seemed to be a good partner to develop her writing skills and continue studying the scientific themes of her time while experiencing great love; how could she resist? Obviously, this romance was initially not well regarded by Émilie's social group since it was a relationship between a woman of high nobility and a commoner. However, Voltaire gradually gained notoriety and, being a man, surpassed Émilie's status. Much of her studies was developed during her tutoring relationships (Émilie could not acquire the books she needed by herself) with scholars of the time, little by little they became obsolete in the face of the intellectual growth of a woman who, in most cases, was self-taught (Badinter, 2013; Zinsser, 2006).

At times, and when rarely mentioned, she is simply introduced as Newton's translator and/or Voltaire's (1694–1778) lover, an eccentric, hysterical and passionate woman. This is her historical identity (Iltis, 1977; Martins, 2022).

¹¹ Human = white men.

¹² An aristocratic woman gains power and respect through her friendship and love relationships, the latter being even more important than the first.

Far from it, Émilie du Châtelet was a mathematical and metaphysical scholar. She studied several languages, even in her childhood, to become the lady that her social position required; she learned literature, music, theater, dance, singing, among other things (Badinter, 2003; Dalmarco, 2013; Zinsser, 2007). Taking advantage of the tutors who were responsible for the education of her brothers, Émilie deepened her studies in mathematics and geometry; and later married, she interacted with scholars such as Maupertuis (1698-1759) in 1733 and 1734; and Alexis-Claude Clairaut (1713–1765) in the 1740s. However, her interest in and defense of Leibniz's metaphysics led her to write a book explaining her ideas, and ended up generating conflicts with the mathematicians of the Academy of Sciences in Paris. In January 1740, she published a 450-page book, *Institutions de Physique*¹³, in which she performed calculations and experiments to corroborate Leibniz's theory of living forces, opposing the Cartesians and Newtonians (Du Châtelet, 1986). The *Institutions* are sources of scientific debates in 18th-century France, making her a controversial philosopher among her contemporaries who, at that time, witnessed the establishment of Newtonian work (Badinter, 2003, ppp. 293–307; Terral, 1995).

The Marquise even wrote about Happiness (Du Châtelet, 2002); she contributed to Voltaire's work on Newton¹⁴ (Voltaire, 2011); she corresponded with several philosophers of the time to defend her ideas, such as Bernoulli and Koenig (Badinter, 2003; Du Châtelet, 1958, 1999, 1878); and her contribution to the translation and analysis of Newton's *Principia* (Newton, 1756) was published posthumously. She died in 1749 a few days after giving birth for the fourth time, shortly after completing her review of algebraic calculations on the *Principia* (Pereira & Silva, 2022).

Analyzing our character's life context makes it possible to illustrate some necessary conditions for a woman to study natural philosophy in France during the 18th century. Émilie manages to develop her research despite the culture and the Enlightenment thinking that prevailed at the time, due to her social position, her tutoring given to erudite men, her perspicacity in choosing her research and her self-taught ability when studying. Understanding how science was done at the time is also understanding the absence of women and the explanations given to this fact. In this sense, this work can be considered close to studies of the Cultural History of Sciences, assuming that science is done by different characters and practices (Burke, 2005).

These were some of her works, briefly presented, among which is the one that motivates us to broaden the discussion on women and science through understanding how the Marquise develops her reasoning and the methods she uses in her first official publication by the Academy of Sciences in Paris, her Dissertation.

This was the first time that the Academy published a woman's text, a privilege that gives the young woman an unprecedented place in the French scientific community (Bodanis, 2012). What is in her Dissertation to achieve such recognition? We understand that the Marquise enjoys a privileged position, but we also believe that there is something

13 We will keep the original title because there are contradictions in its translations.

14 *Éléments de la Philosophie de Newton* (Elements of the Philosophy of Newton).

relevant in her research. The adversities presented here, mostly arising from a limiting thought about women, make Émilie exceptional to us. An example of a woman recognized in her time, little or almost not explored by the historiography of science.

In order to understand the importance of her work for the scientific knowledge of the time and how the Marquise was up to date and within what was expected for a high-level academic work, we present an analysis of her work, considering its conceptual, methodological and philosophical aspects.

Dissertation on the Nature and Propagation of Fire: Context and Main Aspects

The 18th century, also known as the “Age of Enlightenment”, was marked by significant changes, including the way of studying and popularizing research on nature (science). With the discussion and presentation of experiments and observational results, there was a growing need to improve experimental techniques. As a result, many natural philosophers sought artisans who had technical knowledge. In this context, the Academy of Sciences¹⁵ in Paris, established by one of King Louis XIV's ministers in Paris (Silva et al., 2013), was a man-exclusive hub for discussions, debates, the exchange of ideas etc.

In terms of the nature of heat, there was no consensus, with some people adhering to the idea of the motion of something, while others took it as a primordial element - fire - or a principle, such as the phlogiston. Caloric, as a concept of a fluid, opposed to heat generation through motion, only became a possibility in the late 18th century and already had a different conception, as it became part of the periodic table as an identifiable element. (Gomes, 2012; Silva et al., 2013). Under the influence of alchemical studies, the German George Ernst Stahl (1669–1734) referred to the inflammatory principle that bodies possessed as phlogiston, whose effects could be examined through phenomena such as combustion and calcification, which are related to heat. According to Stahl, phlogiston is an eternal element of nature that assumes different forms after being released through combustion and calcification in the atmosphere, a process that only occurs in the presence of air (Wisniak, 2004). There were difficulties in experimentally verifying the consistency of his ideas because measuring the quantity of phlogiston was impossible, and, during the balancing combustion and calcification reactions, it appeared to have no weight. For some natural philosophers, these unobservable entities were justified through divine action, which aligns with metaphysical ideas.

In the late 18th century, studies gained greater precision through experiments and temperature-measuring instruments that adopted standard scales. Research on the temperature variation of pure and mixed substances, with different cooling and heating processes, has made important contributions to understanding the nature of heat and explaining various phenomena. This includes the studies by Joseph Black (1728–1799) on specific and latent heat, attributing the idea of ‘quantity of something’ to heat; and Antoine Lavoisier's experiment (1743–1794) with his glassware, scales, and caloric (Martins, 2009; Silva et al., 2013).

¹⁵ Académie de Science.

However, in the early 18th century, in France, ideas still revolved around motion, element, or principle. The works presented to compete for the award of best discussion on the nature of Fire, issued by the French Academy of Sciences in 1736, followed these ideas, although the phlogiston hypothesis had taken longer to emerge. These dissertations presented both the view of a primordial element, similar to the one advocated by Aristotle, as well as the concept of the subtle motion of matter expressed in Newtonian terms (Filgueiras, 1995). Providing a solution for the nature and propagation of fire entailed the following elements: resolving the balance of calcification and combustion reactions, as we will address in the analysis of the Dissertation; explaining why some bodies burned more easily than others; and analyzing the nature of temperature differences, or why some bodies appeared hotter than others. The distinction between ‘heat’ and ‘fire’ was not simply a matter of semantics, but involved the very nature of the heating process.

It is within this context of discussion and the proposition of the award that Émilie finds herself living in the company of Voltaire in a castle in Cirey, an inheritance that her husband received from his family. In 1737, Voltaire purchased equipment for experiments that helped him find his new passion: natural philosophy. This was one of the first steps in transforming the castle into a sort of academy, with a great influx of correspondence on various topics and research conducted by renowned scholars. All of this movement stems from the award offered by the Academy of Sciences for the best explanation of the nature of fire (Badinter, 2003).

Throughout the entire summer, Émilie observes Voltaire conducting his experiments to discover the nature of fire. They discuss their observations, but she does not hide her disapproval of Voltaire’s ideas, who believes that fire consists of particles with mass and weight, and, therefore, obeying Newton’s laws of attraction (Zinsser, 2009). She becomes passionate about the topic, deciding to secretly compete, but she tells her husband and later, knowing the outcome, she explains her reasons to Maupertuis for doing so:

I couldn’t conduct any experiments because I was working behind Voltaire’s back and wouldn’t have been able to hide them from him [...]. Mr. Voltaire’s work, which was nearly completed before I had even started mine, gave birth to ideas within me and a desire to follow the same path consumed me. I began working without knowing whether I would submit my article, and I didn’t say anything to Mr. Voltaire because I didn’t want to blush in front of his eyes for an endeavor that I feared would displease him. Moreover, when I saw in the newspaper that neither he nor I had won a share of the prize, I fought against it. It seemed to me that a joint refusal with him became honorable. (Letter to Maupertuis, July 21, 1738, cited in Badinter, 2003, p. 284)

In a demonstration of intellectual honesty, she did not expose her ideas to Maupertuis while working on her Dissertation, as he was one of the judges. However, when the results were announced, she told him that:

fire weighs absolutely nothing and could very well be a particular entity that is neither spirit nor matter, just like space, whose existence is demonstrated, is neither matter nor spirit. I do not believe in this unsustainable idea, no matter how singular it may seem at first (Badinter, 2003, p. 285).

Although she praises him, her arguments contradict the ideas that Voltaire defended in his work.

Émilie had a triple workload during the writing of her Dissertation: she managed a renovation in the Castle, assisted Voltaire in his experiments, and at night, while he slept, she wrote her own work. She recounts her exhaustion from the long days of chores that hindered her studies:

There is so much to do when you have a family and a household to manage, so many insignificant details and obligations that I hardly have time to read new books. I give up on overcoming my ignorance [...]. If I were a man, I would simply rid myself of all these useless things in my life. (Bodanis, 2012, p. 178).

The submission of the two papers is done separately, and both Émilie and Voltaire are identified by numbers to maintain the impartiality of the judges (Zinsser, 2009). Émilie dedicates herself to writing a dissertation on the nature of fire in 140 pages, divided into two parts, as we will go over in the next section.

Before knowing the result, she awaited anxiously but had no hope of winning, as she writes: “The originality of my ideas would not let me win, besides the other reason [that is, being a woman]” (Bodanis, 2012, p. 180). Regarding the winners, Bodanis writes:

The first prize was actually shared. Part of it was awarded to a less prominent French researcher who merely repeated an irrelevant — albeit patriotic — pre-Newtonian work, and the other part was awarded to the esteemed mathematician Leonhard Euler, who presented valuable calculations on the speed of sound (Bodanis, 2012, p. 180).

Émilie was right: a woman going against the widely accepted thinking of the Academy would never win. This episode is an example of the influences that scientific activity suffers from, both internal and external sources. The discourse of authority and prejudice often present themselves as obstacles to scientific endeavors (Agrello; Garg, 2009; Moura, 2014).

Voltaire works to have his manuscript published, a common practice. When Émilie reveals to Voltaire that she has also written, he requests the publication of both essays. In a surprising move, the Academy accepts the request and publishes the five works, referring to the couple as “one of the best of our poets” and “a young lady of high standing” in the limited publication of 1739 (Badinter, 2003; Zinsser, 2009). However, the Academy does not allow Émilie to make corrections in a footnote related to living forces, even though she asks for Maupertuis's intervention, which he refuses due to their personal relationship. In 1744, the Marquise revises the Dissertation and bears the costs of its publication in Amsterdam, without the approval of the Academy (Terral,

1995). The Dissertation reappears in a series of award-winning works published by the Academy in 1752, already with the changes made in 1744, and with a clearer and more concise language.

After the published result, other researchers were able to read and provide their comments on Émilie's work. Her friend, Maupertuis, who also leaned towards Newton's ideas, sent the Dissertation to a famous English mathematician and wrote:

Mr. Algarotti is leaving for London, and I gave him this work to pass on to you. Its author is a young woman of the highest merit, who has been working in science for many years, forsaking the pleasures of the city and the court. The article was written for the prize of the French Academy — when you read it, you will hardly believe that they awarded the prize to someone else (Bodanis, 2012, p. 181).

In order to have both his and the Marquise's works published, Voltaire employs an altruistic approach, praising Émilie's work and consistently highlighting her gender and privileged position in a positive way. Even the Academy, when writing the note referring to the Marquise, uses this device as something exotic, worthy of arousing the curiosity of many people (Badinter, 2003).

It aroused curiosity, indeed. Perhaps many have read it in the hope of finding errors, foolishness, or any trace of ignorance; however, since they did not find any, they had to bow down to this erudite woman. The worth and depth of her words are acknowledged, even though this recognition fuels suspicion regarding their originality. After all, only someone with a certain level of education could achieve such a feat, and a woman would not be naturally capable of it. As a matter of fact, the widely accepted belief defended by scholars in the 18th century was that women were inherently incapable of such profound thinking. The French Enlightenment thinkers used this argument about women's nature to justify their exclusion from certain spaces, categorizing them solely as mothers, wives, and housewives, unable to develop logical reasoning (Araújo, 2019). Philosopher Émilie du Châtelet dared to defy the role that women, by nature, were expected to play, and she was aware of her audacity.

In a letter, the Marquise expresses her desire, saying, "I only hoped to attract attention and to be read attentively by the committee members with the audacity and novelty of my ideas" (Letter to Maupertuis, December 1, 1738, cited in Badinter, 2003, p. 291). She succeeded and had her name mentioned with respect within the very serious and misogynistic Sorbonne. There, in front of an assembly composed of bishops and other highly respected representatives, one of her superiors praised Newton, Voltaire, and Madame Du Châtelet, presenting them under the emblem of Theseus and Ariadne (Letter from Jean Bernard Le Blanc to Bouhier, December 26, 1738, cited in Badinter, 2003, p. 291).

In the following section, we will delve into specific aspects of the Dissertation and analyze it based on the methodological and conceptual considerations developed by Émilie. Due to space limitations, we will focus on the analysis of the first part of the Dissertation, extending our analysis to excerpts of the second part¹⁶.

16 For a comprehensive and more detailed analysis, we recommend reading Pereira's work (2022).

A Brief Analysis of the Dissertation on Fire

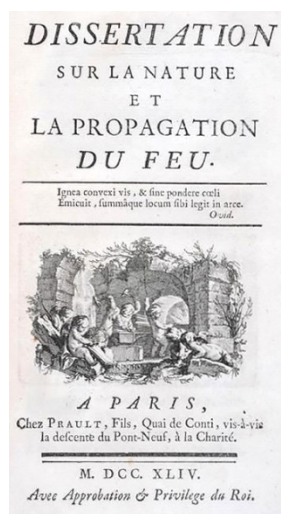
The Marquise's Dissertation is 140-page long and divided into two parts. In the first, the author discusses the nature of Fire, distributing her argument into seven parts that cover everything from the properties of Fire (its impenetrability, for example) to thermometers. Regarding its nature, it is based on the principles of Leibnizian philosophy, especially on the distinction of phenomena and the inherent and inseparable properties of a substance; only after dealing with the distinctive properties of fire did Leibniz conclude that it is neither spirit nor matter.

In the second part, the Marquise deals with the laws of fire propagation, analyzing its effect on different materials and animals in 15 parts. She refers once again to Leibniz's concepts of living forces and dead forces¹⁷. The Marquise explains that the force of fire can be understood as a perpetual combat between its own force and the resistance that the eyes pose to it. Then, she uses Newton's system of attraction to study the effects of the Sun and optics, relating Fire and colors. Although she seeks to synthesize the ideas of the two philosophers, in the end she indicates her preference for Leibniz.

Next, we will discuss some excerpts from the first part of the Dissertation that explain the Marquise's arguments, methodology and main conclusions.

Figure 1

Dissertation, 1744's edition



Source: The Donald F. and Mildred Topp Othmer Library of Chemical History, Chemical Heritage Foundation, Philadelphia, PA, USA. Record link: <http://othmerlib.chemheritage.org/record=b1034935~S6>

The first observation is about the distinction that the Marquise draws between fire, Fire and heat. The term Fire written with a capital F refers to Fire Being; when written with a lower-case f, however, fire refers to a form of manifestation of this Fire Being. She explains:

¹⁷ Vis viva e vis mortua.

I here use the words modes and properties interchangeably to avoid resorting to the same word too often, because, generally speaking, as fire is not always hot and luminous, heat and light are modes and not properties of the being we call Fire (Du Châtelet, 1744, p. 3).

This is her initial explanation, and she continues to use the terms Fire and fire distinctively, distinguishing the property from the mode of manifestation of Fire.

Like Descartes and Herman Boerhaave, the Marquise did not see Fire as matter, nor as spirit, rather she conceived it as something that penetrates all bodies. To argue about its nature, she uses examples of its presence and absence in a deductive and logical process, and discusses the phenomenon of flammability and freezing as if they are additions of something to the substance. Proving her mastery of the rhetorical style of the 18th-century sciences, she also exposes objections and hypotheses and then responds to them one by one (Zinsser, 2009, p. 54).

One must never conclude from the particular to the general, though heat and light are often united, it does not follow that it is always so; these are two effects of the being we call Fire, but do these two properties of illuminating and heating constitute its essence? Can this be disregarded? Is Fire, after all, always hot and luminous? (Du Châtelet, 1744, pp. 3–4)

These are her first remarks and questions about the nature of fire, which reveal her method and arguments. Initially, Émilie argues that fire is not always hot and bright and presents seven experimental and theoretical examples that validate this statement: (i) moonlight compared to candlelight converged by a converging lens and light from both luminous worms and molluscs are not able to warm “so heat is not part of the essence of elemental Fire”; (ii) iron can burn us even though it has no light, “light being nothing else than fire transmitted in a direct line to our eyes, and heat, agitation in every direction...”; (iii) “... light always acts in a direct line and heat insinuates itself into bodies from all directions...” moreover, she affirms that the speed of light is greater than that of heat; (iv) “Another difference... is that a body can lose its light instantly but it only loses heat gradually”, illustrating this with an example; (v) “If we wanted to rely on authority, we could say that Descartes composed Light as his second element and Fire as his first”; (vi) presents the limitations of our senses when attempting to identify the essence of a being as universal as Fire “it seems then that we must identify in Fire some more universal effect that does not depend on our senses for it to exist”; (vii) still on the matter of senses, she explains that we can sense different temperatures when touching the same body, and that our health can affect this perception, if we have a fever “then the heat experienced by our bodies muddles our judgment about the Fire they hold.” (Du Châtelet, 1744, pp. 5–9). In light of these initial considerations, it is evident that her Dissertation shows a vast knowledge of the literature of the time, by recognizing field authorities and other studies, and that it is an amalgamation of experimentation, reflection and hypotheses.

Throughout the first part of the Dissertation, there is a philosophical discussion about the universal characteristic that we could attribute to Fire, such as the property of rarefaction. On this subject, Émilie presents a few objections: the first, “it can be said that rarefaction does not always manifest itself to us...”; the second, “fire, we could say, rarefies bodies by increasing their heat.”; the third, “they may mention that air and water also increase the volume of bodies and thus rarefaction cannot be made the distinctive property of Fire”; fourth, “it can also be said that Fire does not rarefy all bodies alike”; fifth, “finally, it can be argued that the rays of the Moon that make Fire, do not rarefy the bodies to which we expose them.” Thus, the Marquise believes that the rarefaction operated by fire seems to be one of the primitive laws of a Creator, “without this property of Fire, everything would be compact in Nature”, that is, without the divine breath everything would wither in a state of inactivity. “Not conceiving movement as the cause of Fire, as some Philosophers assert”, she presents four reasons why Fire is not the result of movement, as Descartes claimed (Du Châtelet, 1744, pp. 9–16).

Even relying on works developed by the men of her time (since they were predominant), the Marquise directs intense criticism at them, such as those directed at Descartes's philosophy, as he develops his theories in terms of movement, which she questions in the first pages of her work. Her critiques, however, are not for Descartes only, she also directs them at “some Philosophers” who were likely readers of her Dissertation. This fact prompts us to the realization of how confident she was in her study and in what she believed to be right in terms of reason. After all, this was her initial incentive in writing and submitting the Dissertation.

In a feminist poststructuralist analysis, her writing is “daring” for a woman of that time, which is a form of resistance to imposed standards. As previously mentioned, an educated woman does not express opinions contrary to those of men, much less provoke them as Émilie does in her Dissertation. This characteristic is repeated in the analyses she does that, for being long and displaying careful writing, stand out in comparison to Voltaire's work. She comes close to describing fire in terms of the modern concepts of “energy”, an “entity” that animates all substances.

Without this action and this perpetual reaction of Fire on bodies, & of bodies on fire, all fluidity, all elasticity, all softness would be banished, & if matter were deprived for a moment of this spirit of life that animates it, of this powerful agent that ceaselessly opposes the adunation of bodies, everything would be compact in the Universe, & it would soon be destroyed. So, not only do the experiments fail to demonstrate the gravity of fire; but to want fire to be heavy is to destroy its nature, in short, to deprive it of its most essential property, that by which it is one of the sources of the Creator (Du Châtelet, 1744, pp. 40–41).

After examining the experiences on the gravity of Fire, and understanding that Fire is far from tending towards the center of the Earth, she concludes that, on the contrary, it naturally moves upwards. The Marquise presents another tendency of Fire, which is to spread equally in all directions without obstacles. As for this property, the

Marquise mentions having carried out some simple experiments with the flame of a candle that corroborated her assertions. This experiment is simple and can be a source of challenge and discussion in Physics classes; the Marquise's interpretations and her point are contrary to those defended by Voltaire in his work on the nature of heat.

With the help of a thermometer, she makes observations as to Fire and its tendency towards equilibrium through eight different demonstrations, and thus finds the properties of Fire.

One of the distinguishing & inseparable properties of Fire, then, is that it evenly spreads throughout all space, regardless of the bodies that fill it, & that it tends to re-establish the balance of heat between bodies, provided that the cause of the imbalance is no more. It seems quite evident that Fire is capable of more or less movement, as long as the bodies are able to somewhat resist it, or that power is excited by friction, but that absolute inactivity is incompatible with its nature; & that it is Fire which gives to bodies the internal movement of their parts, it is the movement that causes the increase and dissolution of all bodies in the Universe; so Fire is, as it were, the soul of the world, & the breath of life spread by the Creator upon his work. (Du Châtelet, 1744, pp. 48–49)

In this excerpt, we observe elements of different philosophies: criticism to Descartes and greater credit to Leibniz, with the presence of various metaphysical elements. Revealing her predilection and deviating from the obligations of being courteous, the Marquise abandons her role as an “uncritical woman” and performs what appears to be a defiant posture. We must remember that part of her education guided her to take the role of a submissive woman and dependent on men. Her Dissertation, however, is such a work of her own that she authorizes herself to be free of such performances, and even if her references are of men, she does not soften criticisms and affronts. The Marquise ends the first part of the Dissertation by summarizing the characteristics of fire that she drew from her studies:

- 1- That light and heat are two very different effects and very independent of each other, and that they are two ways of being two modes of the being that we call Fire.
- 2- That the most universal effect of this being, the one that it operates in all bodies and in all places, is to make bodies more rarefied, increasing their volume and breaking them down to their elementary parts, when its action is continuous.
- 3- Fire is not the result of movement.
- 4- That Fire has some of the characteristics of matter, like its extension, its divisibility, etc.
- 5- It is not demonstrable that it is impenetrable.

6- Fire is not heavy; it does not tend towards a center like all other bodies.

7- That it would be impossible (even supposing it had weight) for us to perceive that weight.

8- That we find in Fire several properties that are unique to it, in addition to those that are common to it and other bodies.

9- That one of its properties is that it does not direct towards a point, that it extends equally to all bodies, and that it tends towards equilibrium because of its nature.

10- Due to the previous property, Fire constantly opposes the adunation of bodies, and because of this it is one of the sources of the creator, through which this creator vivifies and preserves his work.

11- That Fire is the cause of the internal movement of the parts of bodies.

12- That Fire is susceptible to more or less movement, but that absolute rest is incompatible with its nature.

13- That Fire is equally distributed throughout the space in which in the same area all bodies contain it in equal quantity, except creatures that have life. (Du Châtelet, 1744, pp. 48–50)

Similarly to the other dissertations submitted for the prize, the Dissertation on Fire did not ultimately answer the question about the nature of fire. The Marquise assumes a metaphysical standpoint, incorporating substantialist elements. This question was only answered at the end of the 18th century, with Lavoisier's chemical experiments, which put an end to the ancient idea of the four elements. About the Dissertation, Badinter highlights relevant contributions to natural philosophy:

She was right to attribute to light and heat a common cause. She was also right in stating that differently colored rays do not yield the same degree of heat, a phenomenon that was amply demonstrated afterwards, mainly by the experiments of Abbé Rochon (Badinter, 2003, p. 287).

About the winners, Badinter writes:

Euler was crowned, not because his discoveries went further than those of Voltaire and Émilie, but because he was already one of the greatest geometers in Europe and mainly because he added to his "piece" the formula for the speed of sound, which Newton was trying to discover to no result. The other two dissertations were much inferior to those of the couple, but their Cartesianism guaranteed their value in the eyes of academics (Badinter, 2003, pp. 287–288).

The author's thinking is corroborated with that of other biographers of the Marquise, Zinsser (2009) and Bodanis (2012). Another perception that is shared by these authors is that, in that period, a strong nationalist feeling influenced the philosophers of the Academy in their decision. Around 1740, the Dissertation was read and commented on by Euler (1707–1783), yet, unfortunately, we do not have many letters that plainly reveal his considerations (Hagengruber, 2016).

All of the Marquise's conclusions are the result of extensive knowledge of natural philosophy, her research methods are those most used in her time, which appeal to experimentation without neglecting reason. Her analysis is critical and reflective of the limits of instruments and handling techniques, and it is also possible to conjecture that she had help from artisans, based on other experimental studies by her peers. Thus, we emphasize the merit of the recognition given to the Dissertation by the French Academy of Sciences. Her method and many of her experiments are the same as those analyzed by Voltaire, but from those he derived different interpretations that are widely attacked in the Dissertation, since for him the experiments were conclusive and Fire had weight (Filgueiras, 1995; Zinsser, 2009). Perhaps Voltaire's passion for Newtonian mechanics and his fascination with the empirical method had deceived him.

However, if acknowledgment is due, if the Marquise's methodology and argumentation do not differ from other works of the time, and they are more sound when compared to Voltaire's, why is it that her name is not present in historical studies on the nature of heat? We see no other explanation for that than the issue of the role assigned to her as a woman in the 18th century.

Émilie's story can be used to denounce the inconsistency of the essentialist and universalist arguments of science that deprived women of occupying spaces of power, such as the scientific field. Even now, in the 21st century, we face the significant challenge of creating forms of organization, education and practice through which scientific knowledge and technique can become more representative and inclusive.

Final Considerations

The study of the Marquise Émilie du Châtelet's Dissertation under a poststructuralist perspective allows us to conclude that her absence among the "canon" of studies on heat is more due to her gender than to her incompetence or lack of knowledge. The "power relations" that she experiences are presented through the character's contextualization, revealing the barriers that Émilie faced to be recognized in the academic environment.

Even influenced by European Enlightenment thinking and without being part of academic circles restricted to men, Émilie managed to overcome some ideological barriers, resulting from the culture of her time, and become an influential natural philosopher. With this finding, it is necessary to highlight Émilie's social relationships, as it was through these that she left her vulnerable position by resisting the normative impositions of her time and achieved her due recognition.

An idea to be questioned by the poststructuralist perspective adopted in the narrative of the Marquise is that “the only interesting story from an epistemic point of view is that of geniuses”. Knowing the story of these women makes us reflect on the social roles historically played by them, under the strong male authoritarian argument that limited them and, the more remote the period, the stronger this repression. The Marquise writes her works within a modern methodology for her period, which lasts throughout the 18th century, reaching conclusions that were reaffirmed even in later centuries, in which case she discusses the nature and propagation of heat. Despite the above, traditional historiography focused only on the studies of men as if it were the only relevant history, considering them geniuses by presenting only their “successes”.

Émilie approaches the subject in order to consider various aspects associated with heat at that time, such as its relationship with light, temperature, the principle of conservation of living force, and considers hypotheses of a fluid and corpuscular nature on movement. The hypotheses that she considers and discusses lasted for a long time, showing how up-to-date and well-formulated her work was within the framework of her time.

One of the Marquise's predictions was only later conclusively verified by Thompson “any attempt to discover any effect of heat on the apparent weights of bodies will be fruitless” (Thompson, 1873, cited in Silva et al. 2013, p.16), since the Marquise stated that the experimental results carried out to verify if heat had weight were insufficient, therefore the experiments were not precise. It may seem small, but it was the subject of much research because it was a crucial aspect in defining the nature of heat based on calcification and combustion experiments (which, by the way, are also discussed by Émilie!). Other interpretations of the nature of heat, such as “energy in transit” would only appear at the end of the 19th century (Martins, 1984), when it also became necessary to consider other contexts and intentions to further scientific knowledge.

Our approach presents the rising need to overcome ideas linked to an unequal power relation between the sexes, through reviewing stories, which are sometimes presented as an unquestionable “truth”; a one-sided view of history from a male perspective; the notion that the only interesting story to be told and studied is that of great male geniuses and that their successes are essentialist arguments; and assumptions anchored in the essentialism and universalism of science based on gender discrimination, which contributed to normalize the exclusion of women from science. Studying the history of the Marquise, along these lines, goes beyond questioning these beliefs, it is a critical reading of the materialization of discourses linked to these beliefs. This was a critical exercise guided by a poststructuralist perspective when reading Marquise Émilie du Châtelet. The tools were her original works, her letters, her context, and, more at length, her work on the nature and propagation of Fire.

We understand the complexity of working with the concept of gender in the educational field. Carvalho and Rabay (2015) show how confusing and incomprehensible this concept can be for teachers, who mostly believe it to be synonymous with sex. Paraíso

(1997) establishes that, even though not contemplated in formal curriculum, gender relations are practiced in the educational routine. Therefore, they deserve care and attention. Because, as highlighted by França and Felipe (2018), establishing a dialogue with teachers in initial and continuing education on gender relations and diversity is a goal that will allow for representative and inclusive education, cultural studies (like the present study) make it possible to question normative and seemingly biology-based discourses (bases of the structuralist and determinist thinking).

Thus, it is understandable the reason that led the Dissertation to be published by the Academy in recognition of merit. What is not clear is why this work, so conceptually and methodologically rich, has remained absent from historiographical discussions thus far. Our research discussed the gender issues that were present in the Marquise's life, especially during the period in which she wrote her Dissertation on Fire and her contributions to natural philosophy. The results reveal that her philosophical choices both opened and closed doors in the academic environment in France, but that being a woman was regarded as a more relevant fact to historiography.

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Compliance with Ethical Standards

The authors declare this study was conducted following ethical principles.
