2025
V.18

História da Historiografia

International Journal of Theory and History of Historiography

ISSN 1983-9928

Sociedade Brasileira de Teoria e História da Historiografia

UNIRIO

UFOP

Special Issue | SI

Beyond the performativity of language. The linguistic turn and social constructivism in *Leviathan and Air-Pump*

Beyond the performativity of language. The linguistic turn and social constructivism in *Leviathan and Air-Pump*

María de los Ángeles Martini

mmartini@sociales.uba.ar

https://orcid.org/0000-0003-3593-3217

University of Buenos Aires, Department of Sociology, Buenos Aires, Argentina

National University of Moreno, Center for Media and Communication Studies, Moreno, Argentina

Abstract

Forty years after the publication of Steven Shapin and Simon Schaffer's book, *Leviathan and the Air-Pump*, this paper aims to examine the philosophical commitments that the authors assumed when they recognized themselves as part of the social constructivist perspective of Strong Programme. This vision, deeply rooted in Wittgensteinian philosophy, addressed the analysis of scientific knowledge in defense of the primacy of practice. However, constructivism has been naively interpreted as limiting itself to the performativity of language. The review of these commitments allows me to explore the affinities between language and materiality in the framework of their work. Finally, I examine the approach that the authors made to the philosopher's body as constitutive of the experimental form of life in seventeenth-century England. I seek to clarify where the conceptual effort and complexity of investigating scientific practices through Wittgenstein's notions of form of life and language-game lay.

Keywords

History of science; Linguistic turn; Constructivism

Introduction

Forty years have passed since the publication of Shapin and Schaffer's (1985) book, *Leviathan and the Air-Pump* (hereafter *Leviathan*). This is an opportune moment to review the retrospective glance at this work and its reception in academic circles, which the authors presented in the introduction to the new 2011 edition. Shapin and Schaffer not only give notice of the tensions which arose at the time of its publication, but also of those raised by the rereadings made by some of the reviewers. Thus, they point out that it was not easy to classify the book within any disciplinary field or to establish its significance at the time of its publication, because "the relevant humanistic and social scientific disciplines have been rounding up their wagons, expelling intruders from their midst, and ever more powerfully controlling their members' bibliographies, their senses of legitimate problems, pertinent resources, and approved modes of writing" (Shapin and Schaffer, 2011, p. l). Although the authors recognize "how fragile the conditions were for anything like this book to be written, published, and found intelligible" (p. l), they present it as a historical document, a product of its time.

In spite of this vision of its origins, the motto of *Leviathan*, "solutions to the problem of knowledge are embedded within practical solutions to the problem of social order, and that different practical solutions to the problem of social order encapsulate contrasting practical solutions to the problem of knowledge." (Shapin and Shaffer, 2011, p. 15), was intended, in accordance with the authors' aspirations, to mark an agenda of historical studies of knowledge:

> A study of experimental practice in seventeenth-century England may be a pertinent resource in telling stories about, for example, *knowledge making* and how one might profitably go about studying how knowledge is made in a wide range of times and places. [...] That was the kind of thing being gestured at when it was said that solutions to the problem of knowledge are solutions to the problem of social order" (Shapin and Schaffer, 2011, p. xlii-xliii).

Historical case studies, in which forms of knowledge-making and social order-making are presented together, are the very demonstration of how all knowledge is generated. Shapin and Schaffer's historiographical perspective assumes that scientific knowledge is formed from ordinary processes of interaction in mundane practices.

Now, when the authors address the critical reviews written at the time of publication, they point out that, although most critics found the detailed analyses of the operation of the air-pump and the politics of the Restoration satisfactory,

> some readers accepted these aspects of the book on the basis of their own empirical competencies; others took them "as read" because they sensed that the book's significance lay elsewhere [...]. Two assessments of the 1989 paperback edition, by the philosophers Ian Hacking and Bruno Latour, used the book as a platform to discuss that significance. They both did so through a robust assimilation of the book's story about early modern experiment, and politics into their own versions of the long-term emergence of modernity (Shapin and Schaffer, 2011, p. xxxi-xxxii).

Beyond the ironic tone of some of the expressions used in the summary of the reviews, the authors draw attention to the tension surrounding the meaning of the book. This tension derives from the relevance that *Leviathan* gives to the local circumstances of the generation of scientific knowledge and to the heterogeneity of visions and problems present in the processes of science in formation. In this sense, *Leviathan* focuses on the everyday and mundane aspects of scientific practice. Such practices are investigated in the small, the intimate, the personal, the embodied and the emotionally textured and, frequently, in the domains of the familiar and the face-to-face (Shapin, 1999). This is why the authors signal that "*Leviathan and the Air-Pump* was, in one sense, quite a traditional historical exercise: it took historical particularism seriously", avoiding any "reference to a coherent «essence» of seventeenth-century science, of what it meant to be «modern», of «the Scientific Revolution»" (Shapin and Schaffer, 2011, p. xliv).

Thus, they engage with the conventional and artefactual character of all knowledge and explore new methodological strategies so that their history makes visible the contingency of scientific practices, which in the present are imposed as evident or inevitable; in the words of Schaffer (2010, p. 278), "the projects whose self-evident authority thus seem to need little if any historical analysis nevertheless require a form of estrangement that allows us to see the situated contingency and particularity of their everyday life". What is evident to us in relation to the case addressed in the book is that the experimental method brings together the appropriate practices for the production of reliable knowledge. In this sense, *Leviathan* seeks to show that the ship that is now in the bottle was once a pile of rods and strings (Shapin and Schaffer, 2011, p. 7).

By contrast, the reviews of Latour and Hacking, with their long-term perspectives, "thus offered magisterial accounts that placed the contests between Boyle and Hobbes at the roots of modern order" (Shapin and Schaffer, 2011, p. xxxiii). Latour (1990) undertakes a critical review of *Leviathan* that will be the prologue to *Nous n'avons jamais été modernes* (1991). As Ian Hacking (2009) points out, the French translation of *Leviathan* (1993), which was made possible thanks to Latour's own publisher, introduces a change in the subtitle that indicates the direction of his

gaze. While the subtitle of the original version is "*Hobbes, Boyle and, the Experimental Life*", the French edition reads "*Hobbes et Boyle entre science et politique*". From this perspective, the controversies between Hobbes and Boyle, which reveal the contingent and conventional nature of knowledge in the analysis of *Leviathan*, constitute, according to Latour (1990, p. 148), the disagreements "in the middle of Revolutionary England", which "are turned into the "fruit flies" of the new social theory of science the authors develop". The "fruit flies" is a figure that indicates the entry of pure contingency into long-term history: Boyle and Hobbes fought to invent a science and a context and a division between the two. This does not mean that Boyle created the scientific discourse and Hobbes the political discourse. Boyle invents a political discourse in which politics should not count and Hobbes designs a scientific policy where experimental science should not count. This division is the profound separation that modernity devises between scientific power and political power; the invention of our modern world, a world in which the representation of things mediated in the laboratory is forever separated from the representation of citizens mediated in the social contract (Latour, 1990). In other words, science was given the role of representing non-humans, but was forbidden any appeal to politics; politics, on the other hand, assumed the role of representing citizens, at the cost of being forbidden any relationship with the non-humans produced and mobilized by science and technology. The modern world must live under this Modern Constitution (Latour, 1991).

In addition to this shift in meaning, Latour makes another move, one that is not directed towards the long-term but to that of the recognition of the value that materiality assumes in the analysis of the generation of knowledge and social order. He claims that *Leviathan* is part of a counter-Copernican revolution:

> This is where the book becomes so important. In what is no less than a reverse Copernican revolution, Shapin & Schaffer make their analysis and that of their characters turn around the object, around this specific leaking and transparent air pump. The practice of object-making regains the central place it had lost with the Critique [of Kant]. [...] The beauty of Shapin & Schaffer's book is that they push to the limit their argument on objects, laboratory, skill, and variation of scale. [...] science is not idea-based but practice-based, [...] it is not outside but inside the transparent container of the pump and inside the transparent private space of the experimental community (Latour, 1990, p. 152).

Thus, as a member in its own right of the field of science studies, *Leviathan* also pays "an obsessive attention to the material, historical, and practical conditions necessary for the

discovery of new cognitive skills" (Latour, 2008, p. 441). Ian Hacking's references to the work of Shapin and Schaffer also show an assimilation to a long-term historiography and a recognition of the centrality of the material. Hacking's review of *Leviathan*, published in 1992, established links intended to build a way of thinking with others beyond disciplinary boundaries, at the very moment when the realism/antirealism debate made a fruitful relationship between philosophy and the field of science studies unthinkable (Martini, 2023). Hacking (1992a) warns that the merit of the strong Program of Barry Barnes and David Bloor is rooted in its being the counterpoint to a philosophy that has lost interest in the details of how scientists actually carry on. In spite of this, the importance which these social studies of science give to the particularities of situated knowledge pass a limit:

> Quitting work early in the day, they [the constructionalists] leave us in the lurch with a feeling of absolute contingency. They give little sense of what holds the constructions together beyond the networks of the moment, abetted by human complacency. We now need to examine something in between timeless metaphysics and the momentary social conjunctures (Hacking, 1992a, p. 131).

The response to this tension is to be found in the Hackinean styles of scientific thinking and doing, through which Hacking seeks to link together social dimensions, metaphysics (questions about truth, reality, logic, meaning and knowledge) and long-term aspects of science. There is nothing that makes the rise of these styles necessary. They crystallize, that is, they have an historical origin, a anchoring point to be followed in the future, on the basis of which they evolve dynamically within human social interactions. Their emergence is inseparable from the social institutions which develop them. They prosper and are popular for a while, until they are abandoned, become moribund and even die out. (Hacking, 1992a; Martínez Rodríguez, 2021).

In the times in which a style crystalizes, the social dimensions are in full view: "If you want interests, we have interests. If you want rhetorical devices, we have those. And institutions, modes of legitimation, takeover battles, constructions, uses of power, networks, intimations of control, and much, much more" (Hacking, 1992a, p. 133). But, once a style stabilizes, it obtains autonomy from any concrete social order. In this sense, Hacking's interest focuses on explaining the autonomy of the styles of scientific thinking and doing and on how a style constitutes itself in the condition of possibility or in an historical a priori for the rise of concepts and objects, of sentences, of making knowledge and making truth, and in the particular case of the laboratory style, he seeks to explain how this style "has become autonomous of its promiscuous beginnings that are so well recounted in this book [*Leviathan and the Air-Pump*]" (Hacking, 1991, p. 236).

Nevertheless, Hacking integrates *Leviathan*'s analysis of seventeenth-century English experimental philosophy into a narrative that focuses as much on the dialogue between contingency and permanence as on materiality: "I think of the material aspect of experiments as something [...] central to their stabilization. By material I mean the apparatus, the instruments, the substances or the objects investigated" (Hacking, 1992b, p. 32). *Leviathan* places the material nature of experimentation at the center of its focus through the investigation of the emergence of a new kind of character, a new kind of place, and a new kind of fact. From this perspective, it is a story that recounts the life of a device, an air-pump, that creates effects that did not previously exist in isolation and outside of experimental practices - its invention, the controversies that surround it, its technical problems, its triumph, its obsolescence and, finally, its irrelevance (Hacking, 1991; 2006; 2009; 2012).

Although, as I pointed out above, Shapin and Schaffer disagree with the assimilation of their work to a long-term historical perspective, they do agree that the book "is indeed about an instrument and about a wide range of collective human practices attending the operation of the instrument, the interpretation and evaluation of its products –the knowledge tracing back to it and the forms of social relations accompanying it" (2011, p. xxxviii). Certainly, for the authors, scientific knowledge-making is work, a collective performance and, as such, it implies a material dimension. There are no knowledge practices without bodies, materials, instruments, institutions and places.

At the same time, they argue that *Leviathan* was an instantiation of a research programme in the sociology of scientific knowledge. From this perspective, the book shares with the Strong Programme a constructivist view of knowledge. However, the idea of social construction, which was adopted by the sociology of scientific knowledge and the history of science related to it, is strongly permeated by Wittgensteinian non-deterministic semantics. The notions of social institution and finitism, central to the Strong Programme's conception of scientific knowledge, are of Wittgensteinian origin. Shapin and Schaffer explicitly give a Wittgensteinian cast to their inquiry:

> we will make liberal, but informal, use of Wittgenstein's notions of a "language-*game*" and a "form of life". [...] Just as for Wittgenstein "the term 'language-game' is meant to bring into prominence the fact that the *speaking* of language is part of an activity or of a form of life", so we shall treat controversies over scientific method as disputes over different patterns of doing things and of organizing men to practical ends (Shapin and Schaffer, 2011, p. 15).

In this respect, I would like to point out that, in addition to the contingency-permanence tension, there seems to be another underlying tension. Latour's and Hacking's recognition of the epistemic value of the material in Shapin and Schaffer's analysis of seventeenth-century English experimental philosophy seems to be in contrast to the authors' own emphasis on its insertion within the framework of the linguistic turn and social constructivism. The criticisms that social constructivist perspectives and those within the linguistic turn have received since the late 1990s focus on the tension between language and materiality. According to these criticisms, the linguistic turn, the semiotic turn, the interpretive turn and the cultural turn have granted too much power to language. Materiality has become a matter of language or some other form of cultural representation. Matters of fact have been replaced by matters of meaning (Barad, 2003). Although it has not been a unified research program and the metaphor of social construction has been applied in very different ways, constructivism is still often associated with the idea that representations are ontologically prior to their associated objects; that scientists somehow construct the world when they arrive at a consensus (Sismondo, 1993). In this respect, critics claim that, although social constructivists and traditional realists have had fierce philosophical controversies, they share a common metaphysical commitment: words have the power to reflect pre-existing phenomena (Barad, 2003).

In this paper, I propose to analyze Shapin and Schaffer's philosophical engagements with the linguistic turn in order to explore the affinities between language and materiality within the framework of their work. My paper undertakes a charitable analysis of the perspective of the linguistic turn in these science studies in order to show that *Leviathan* was far from conceiving of performativity within the narrow limits of language. My aim is not to argue that constructivist science studies advanced the theses of the neo-materialisms and their revisions of the terms "discourse" and "matter." Rather, I seek to clarify where the conceptual effort and complexity of investigating scientific practices through Wittgenstein's notions of form of life and language-game lay.

The priority of practices

Shapin and Schaffer close their book with a phrase that, although widely discussed from different perspectives, expresses in abbreviated form the conception of scientific knowledge that runs through their historiography:

> As we come to recognize the conventional and artifactual status of our forms of knowing, we put ourselves in a position to realize that it is ourselves and not reality

> that is responsible for what we know. Knowledge, as much as the state, is the product of human actions (2011, p. 344).

The commitment of their historiographical work to the constructivist theses of the Strong Programme involved recognizing the artefactual and conventional character, not only of science, but of historical knowledge itself. This led to an understanding of science in its situated specificity and, at the same time, meant a break with historiographical traditions that essentialized science, understood scientific ideas in isolation from their context of use, attributed to these ideas an intrinsic agency, and celebrated and defended the past of science as a harbinger of the present. To elaborate stories about scientific knowledge, the scientific method, or truth is to tell stories about a set of embodied practices; it is to create stories about science as a practice "produced by people with bodies, situated in time, space, culture, and society, and struggling for credibility and authority" (Shapin 2010).

Leviathan is a constructivist history of science informed by Wittgenstein's philosophy, "because of his stress on the primacy of practical *activity*" (Shapin and Schaffer, 2011, p. 15). However, understanding the meaning of this primacy of practice requires a review of the metaphysical commitments that have been attributed to social constructivism. To this end, I focus on Ian Hacking's (1999) reconstruction of these commitments and on David Bloor's (1997, 2001a; 2001b;) review of the characterization that has been attributed to the constructivist perspective. The analysis of this counterpoint will allow me to evaluate whether the theses of the Strong Programme, a social constructivism that recognizes itself as Wittgensteinian, develops a tension between language and materiality.

Hacking (1999, p. 6, 12) points out that constructivist arguments appealed to the notion of social construction so as to refer both to a circumscribed product and to the plurality of processes that gave rise to that product. It is for this reason that, in his general characterization of this perspective, he seeks to clarify this ambiguity. He argues that the assertion that something, *X*, for example, is socially constructed requires a precondition: "in the present state of affairs, *X* is taken for granted; *X* appears to be inevitable". Once this point is accepted, the constructivist step lies in supporting the thesis that "*X* need not have existed or need not be at all as it is. *X*, or *X* as it is at present, is not determined by the nature of things; it is not inevitable". From here, Hacking explains the metaphysical commitments that he considers to be central to constructivism.

The first commitment posits the so-called "contingency thesis," as opposed to inevitabilism. Knowledge is grounded in the local circumstances of its production and could have been considerably different without necessarily being worse: "The constructionist argues

that the product [social construct] is not inevitable by showing how it came into being (historical process), and noting the purely contingent historical determinants of that process" (Hacking, 1999, p. 38). The second commitment is identified by Hacking as "nominalism." Classifications are not determined by how the world is, but are convenient ways of representing it. Facts are consequences of the ways we represent the world, rather than parts of an inherent structure in the world. Finally, Hacking makes explicit a commitment to the question of the stability of scientific knowledge. Social constructivism maintains that the sources of stability are external, as opposed to an internalist view that takes into consideration only epistemic elements in its explanation.

This dichotomous presentation, though overly simplified to exhibit the problems faced by the Strong Programme and the theoretical proposals it developed in this regard, constitutes an approach which is highly relevant to understanding the limits within which constructivism was framed. Bloor problematizes the meaning of these metaphysical assumptions and displaces the problems and divergences around contingency, nominalism and stability outside the dichotomous relationship.

Let us look at the first assumption. Hacking (1999, p. 165) notes that his main point of disagreement with constructivism is what he calls "contingentism". He defines his position on this issue in terms of a distinction between form and content. By form, he understands "a structured set of declarative sentences that stand for possibilities, that is, sentences that can be true or false, together with techniques for finding out which ones are true and which ones are false" (Hacking, 1999, p. 170). In a simplified way, if the form is given by the set of questions that can be asked and that determines the space of possibilities within which the answers are framed, then the content of a science is constituted by these answers. Hacking considers himself a contingentist as regards the form of science, but not as regards its content, maintaining a kind of harmony between contingency and inevitability.

However, this response to the contingency-inevitability dichotomy presents serious difficulties from the perspective of the sociology of scientific knowledge. While it makes sense to maintain that distinct scientific traditions differ in the type of questions they pose, this does not authorize the assertion that these questions have determined answers such that they remain outside the scope of negotiations, contingency and history (Kusch, 2002a).

Bloor (2000) reformulates the problem in support of a history of naturalistic science that accounts for knowledge as a form of local knowledge, a craft activity and a system of traditional authority. It is a historiographical approach, whose stories

> take agreement and consensus as principal matters in need of explanation. Historians of the sciences are peculiarly concerned by the processes through which any kind

> of provisional or local stability is ever achievable. [...] Attention is therefore devoted to the practices of socialization, enculturation and training through which members acquire the sense of conventional behaviour and learn ways of estimating similarities and going on in ways that count as practically comparable (Schaffer, 2010, p. 278).

Bloor signals that while Hacking's contingency thesis makes it possible to hold, in general terms, that "we choose the rules we want to follow, but we can't choose what happens when we then follow that rule" (2000, p. 605), the analysis of the Strong Programme aims to problematize the use of everyday rule following. More precisely, the problem is posed in Wittgensteinian terms as the passage from previously known cases of rule following to new cases. The Strong Programme addresses the problem of the step to the next case examining how rule following is taught and learned.

Teaching a word, for example, is in some sense teaching the rule for using that word. However, and this is a first point of importance, since rule following, according to Wittgenstein, is an exemplary case of the priority of practice over theory, it is not appropriate to claim that the meaning of the rule (if we accept that meaning falls under the label of "theory") precedes and determines the action of following it:

> it must be possible to show how a practice can grow up without depending on some prior «theory» about it. If that is possible [...] then ostensive training will take care of the transmission of the [...] practice in an appropriately nondiscursive way (Bloor, 2001a, pp.107-108).

Thus, the Strong Programme assumes a non-deterministic semantics: meaning finitism. Finitist semantics allows us to understand that language learning is rooted in training based on ostensions. Children usually learn the meanings of words that refer to objects in their environment by paying attention to where their parents and teachers point. Ostension is crucial and basic, since even verbal definitions often rely on ostensive definitions.

According to Bloor (1997), and this is a second relevant point, Wittgenstein draws attention to a feature of this teaching-learning process. This feature is undeniable when it is pointed out, even though it is often overlooked. The number of illustrations and examples that can be offered by ostension is always finite, even if the rule is infinite. Thus, whoever learns a rule goes from a finite number of examples to an indefinitely extended range of future applications. Since "concepts do not come with labels attached, carrying instructions which tell us how they are to be

used" (Barnes 1981: 313), future applications of the terms are open-ended. We arrive, then, at the problematic step of the next case. If practice precedes theory and meanings neither precede nor are a condition of possibility of historical linguistic practices, "what, for example, makes the next bird a bird, or the next electron an electron?" (Barnes, 1982b) and "how do I know what to do at *this* point?" (Bloor, 1997).

This training through ostension and approval or sanction by an authority is favored by a set of dispositions that are activated thanks to the examples used. The functioning of these dispositions can be reconstructed as the elaboration of judgments of similarities and differences between the set of learned examples and the new cases found that are considered candidates for inclusion under the same term. Since we develop dispositions to establish relations of similarity, but not stronger relations of identity, these dispositions are not sufficient to create a normative standard of right or wrong.

In any case, it is worth pointing out that, while there is nothing in the nature of things, language, and past usage, that determines how we use or correctly use our terms (Barnes, 1982a), Bloor warns about the weight of the circumstances surrounding each particular act of applying concepts:

> The real sources of constraint preventing our going anywhere and everywhere, as we move from case to case, are the local circumstances impinging upon us: our instincts, our biological nature, our sense experience, our interactions with other people, our immediate purposes, our training, our anticipation of and response to sanctions, and so on through the gamut of causes (1997, p. 20).

However, the phenomenon of language normativity can only be understood from an intersubjective perspective, primarily involving the community. An individual's conduct will be considered correct or incorrect, depending on whether or not it conforms to the conduct agreed upon by the members of his or her community. Justifications can be made for our normative judgments, but ultimately only agreement in practices remains (Penelas, 2020).

We should not assume that this analysis is reduced to linguistic practices: "all scientific actions, observing and representing as well as experimenting and intervening; all these are contingent actions covered by the finitist account" (Barnes, Bloor, Henry, 1996, p. 109). In this sense, the Strong Programme's social constructivism addresses the contingency of all scientific knowledge and practice from the logic of finitism and in response to the problematization of consensus and agreements in science. Contingency is detached from its dichotomous counterpart,

inevitability, and is linked to the priority of practice in the generation and application of scientific knowledge. Now meaning finitism assumes an intersubjective normativity in determining agreement itself in linguistic and nonlinguistic practices. Can it engage with the idea of a reality independent of ourselves that is implied in the priority of practices? This question leads to the second metaphysical commitment.

The central dichotomy with which Hacking characterizes this commitment is reconstructed by Bloor (2001b) as follows: we have two basic types of resources in order to create and apply concepts. On the one hand, empirical resources encompass the observable properties of the objects to be classified; on the other, traditional resources include other people's practices towards these objects, among these practices, their ways of naming them. On the basis of these resources, two extreme stereotypes inform the problem of knowledge and classifications in such a way that "we seem turned between 'reality' and 'society' as if there is a tug-of-war between them" (Bloor, 2001b, p. 143). The first stereotype is given by an individualist epistemic perspective, which defends the dependence of the classifications of objects and the independence of these objects. The second stereotype is based on a sociological idealism, in which talk is modeled simply on other talk. This presentation in terms of a zero-sum game reduces constructivism to a fantastic form of idealism and renders it incapable of going beyond these dichotomies.

However, the Strong Programme frames this problem within the more general issue of the ontology of rules. Bloor (1997) takes up the Wittgensteinian slogan "rules are institutions". Thus, the elucidation of the concept of social institution is required. Such an analysis not only makes sense of the idea that social constructions are institutions (Bloor, 2001b) and, consequently, that knowledge is a social institution, but also makes it possible to explain what relations are founded between linguistic and non-linguistic practices and objects in the establishment of an institution.

The basic examples of institutions that Bloor presents are money or leadership. In both cases, the collective practices of calling money "money" or someone "leader" constitute them as institutions. Bloor (1997, p. 27) employs an extended sense of "calling" that goes beyond verbal performances to encompass different forms of practices:

> My references to things being called "coins" is shorthand for the entire repertoire of behaviour associated with their being thought of, or regarded as, or treated as, coins [...]. On this usage, speaking of a thing as a coin isn't meant to refer to a purely verbal act, but to the whole pattern of behaviour into which such explicit verbalisations are woven.

Now these examples point out the self-referential character of institutions: the referring practice is not directed at an object that exists independently of the practice of reference. The statuses of money and leader "do not exist outside of the practice of referring to them. But if there is no independent object of reference, that which is referred to can only be the acts of reference themselves. Taken all together the acts can only refer to one another" (Bloor, 2001b, p. 145). These statuses do not exist outside of attribution practices, such that citing them as a reason and justification for various courses of action, taking them into account in our calculations and, in general, referring to them, and even denouncing them, denying them or renouncing them can contribute to their social reality.

In the same way, the term 'knowledge' and its cognates, like 'know' and 'knower', mark a status. As Kusch states, "Knowledge is a social referent created by references to it; and these references occur in testimony - as well as in other forms of talk. Such talk includes claiming that something is knowledge, challenging knowledge, testifying to knowledge, questioning knowledge" (2002b, p. 71). The same goes for scientific concepts and empirical discourse in general.

However, the self-referential character of the institution does not deny the corporeality of the leader or of money, nor does it deny the material consequences that follow from the functioning of these institutions. Furthermore, without their corporeality and the corporeality of those who perform the practices around them, the self-referential processes that constitute institutions would be impossible. If we all stopped thinking about money and acting in relation to it, the pieces of metal or paper would continue to exist, but the money would not. However, this does not mean that the pieces of metal or paper are complete forms that confront the observer as faits accompli. They are also institutions and as such finitistic in character.

If we consider concepts to be institutions, it is necessary to explain how their meanings are generated at the same time as they are applied. The standards of right and wrong concept application and the content of concepts are constituted by self-referential processes. However, social interaction comes into play without discarding or diminishing the role played by causal interaction with things. Each complements the other through the interaction between language users. Engagement with the world is a collective engagement that occurs in terms of self-referential practices inherent to the constitution of institutions (Bloor, 2001b, p. 149).

In short, according to the Strong Programme, rules are institutions, and rule following is participating in the relevant institutional practices. The ontology of rules is social. They are constituted by self-referential processes. However, self-referentiality does not jeopardize the commitment to an independent reality. We interact with the environment collectively according to practical ends. This material-social practice is the precondition of objective knowledge:

> The great error is to think that practical and objective cognition must be a response to the physical environment rather than a response to society, as if the two were exclusive. [...] The self-referential analysis of institutions does not therefore undermine the practicality of our knowledge but describes a precondition of it. [...] [The] social practices are an integral part of any other cognitive practices. This is not to compromise the principle of the priority of practice, but merely to articulate and explain it (Bloor, 2001b, pp. 112-113).

As for the last point, the problem of stability, the Strong Programme's sociology of knowledge once again moves away from the dichotomy presented, in this case, the determination of the stability of knowledge in internal or external terms. This problem is framed within the question of the limits of scientific practice. The historiographical problem of how to reconstruct the delimitation of scientific practice questions the situated practices through which a scientific community creates and stabilizes the uses of "science" and "scientific knowledge" according to its purposes and interests.

The boundary-drawing of science is thought of in terms of Wittgensteinian notions of form of life and language-game. The linguistic and non-linguistic practices that weave a language-game into a given form of life are open-textured. It follows, first, that "the boundaries of language, like the boundaries of concepts themselves, are social accomplishments. They too have the status of conventions or institutions" (Bloor, 1997, p. 67). Second, this finitist view of boundaries has consequences for the history of science. Without first undertaking a historical investigation, historians shouldn't dismiss any aspect as irrelevant to a given situation of the construction, stabilization or displacement of boundaries. Finally, an analysis of the stability of scientific knowledge in terms of internal-external would not be fruitful: "We recognize a continuing form of life where people remain coordinated in their use of shared knowledge/culture, in their practice, even as and if the practice itself develops and changes" (Barnes, Bloor and Henry, 1996, p. 117). The boundaries of science, thus understood, are permeable and their movements depend on how scientists appropriate and use the resources available through their practices. Seen in the light of finitism, "we can understand them [boundaries] as a set of constructed and maintained marks in cultural space which allow collectivities effectively to tell members where they are, where they may and may not go, how permissibly to behave in this place" (Shapin 1992: 355).

Leviathan can also be considered an exemplary historiographical case of the reconstruction of the boundaries of English experimental philosophy in the seventeenth century. The experimental form of life maintains the concordance of epistemic, material and social practices

in the joint configuration of a research method –the experimental method–, the identity of the experimental philosopher and the organization of a philosophical community, which is offered to the English society of the Restoration as the expected social order that will preserve it from the civil war.

Thus, the tension that I expressed at the beginning in terms of language and materiality was very much present in the problems that ran through the Strong Programme's research into scientific knowledge. This tension was not thought of in dichotomous terms, but was informed by Wittgensteinian philosophy as the problem of the primacy of practice. With their feet firmly planted in ostension, that is, in "simple empirical concepts defined by ostension, i.e. concepts involving an undeniable engagement with our material environment", Strong Programme problematized why "the content and meaning of such concepts derives from their being part of a language-game" (Bloor 2001b, p. 150). The answer was in the finitism that did not separate linguistic practices from non-linguistic ones in the joint explanation of knowledge, the social and the natural. Bodies and spaces were constituted as conditions for knowledge to exist, however, they were not thought of as closed things from which knowledge is constructed but as open-ended institutions crossed by the logic of finitism.

Bodies, practices and knowledge

The priority of practice inevitably plunges us into the corporality of scientific knowledge. Practice is a body-centered and body-dependent category. Starting from this consideration, I will examine the value that the bodies of scientists assume in Shapin and Schaffer's history of seventeenth-century experimental philosophy. My aim is to focus on the links that connect the body to the generation of knowledge in order to make visible how the dynamics of finitism are brought into play. This means making evident the way in which the bodies of scientists are constituted together with a new social-order and a new knowledge-order through the process of delimiting a language game and its consequent form of life.

Shapin and Schaffer's history of science has considered bodies, places, and trust as preconditions for all scientific knowledge, as it manifests itself in situated contexts (Shapin, 2010). Once this postulation is accepted, it is necessary to clarify in what sense bodies are a precondition of knowledge.

Let me start from Mario Biagioli's (1995) reflections on the bodies of scientists. This historian of science points out that the interest of science studies in the body of the scientist derives from the notion of tacit knowledge. The Kuhnian use of the notion of tacit knowledge

(an appropriation of Polayi's concept) aimed to show that the connection of linguistic statements with observations was the tacit result of the training of the perception of scientists, rather than an adjustment to explicit rules. This tacit knowledge, fundamental for the generation of knowledge in general, is taught through practice and is difficult to make explicit. However, from a Kuhnian perspective, the embodiment of the mind of scientists was limited to perceptual apparatuses and training. From this starting point and with the interest focussed on experimental laboratory practices, historians and sociologists of science directed their investigations towards the bodies of experimenters. Scientific training resides in learning "how to *move around* and operate in a laboratory (or in field) and to tinker with instruments. Tacit knowledge is of the body as much as of the mind" (Biagioli, 1995, p. 71). The study of cases of replication of experiments, both in current science and in the past, showed that the knowledge necessary to achieve success travels with bodies and not only with texts. Bodily skills are actualized by the scientist being present in the laboratory, participating in the construction of devices and interacting with them. Biagioli concludes that skills are a body-related version of tacit knowledge, which as such cannot be made explicit. Hence the difficulty faced by historians in studying the adjustments between skills, replication of experiments and production and calibration of experimental apparatus.

However, both in relation to his own historiographical work and to the work of Shapin and Schaffer, Biagioli (1995, p. 73) points out that:

> [because] we study early modern scientists active within the culture of the princely court or of gentlemanly circles, we can utilize a much wider range of evidence about the bodily skills –skills that were integral to their self-fashioning as natural philosophers and that framed their argumentative and experimental performances.

This analysis allowed us to consider that the cultural resources available in gentlemanly society framed the conditions of possibility of the experimental form of life. Knowledge-making places, trust in knowledge-makers and their bodies, are social institutions, which are constructed together with experimental knowledge informed by the available repertoires of identity and ways of gentlemanly living. Repositories, too, as conditions of possibility, follow the logic of finitism, that is, they are maintained and transformed by linguistic and non-linguistic practices in the space of a language game.

Thus, in relation to the topic of trust, the centrality of testimony in the generation of facts required experimental philosophy to urgently answer the question "Whom to trust?". Shapin states:

> appreciations of gentle integrity, honour and free action were available to warrant belief in what these people said about the world, including the natural world to which they had access and to which others did not. Gentlemanly identity in such cultures provided adequate grounds of trust (1998a, p. 8).

Experimental philosophers also had to shape the status of places considered as laboratories and the standards of conduct that applied there. The laboratory was a place where social relations frequently occurred: the public rooms of a gentleman's private house (Shapin, 1988). The conventions that regulated discourse and actions in the main hall were available to construct this new space and the social relations appropriate to it. This model allowed experimental knowledge to move between private spaces, where experiments could be tested, and public spaces, where they could be exhibited: "The laboratory was, therefore, a disciplined space, where experimental, discursive, and social practices were collectively controlled by competent members" (Shapin and Schaffer, 2011, p. 39).

As for the body of the experimental philosopher, while *Leviathan* focused on the analysis of bodily skills and their characterization as tacit bodily knowledge, I consider that it went beyond the examination of the disciplining of the skills of knowers and experimenters. In order to show the different layers that are juxtaposed in the configuration of the body of the experimental philosopher and even of those who are not recognized as knowing-makers, I include in my analysis not only *Leviathan* but also other works, that Shapin and Schaffer have written individually, that take up the topic that concerns us at this point.

I locate a first approach to the body of the experimental philosopher in the configuration of the limits of the experimental form of life. The construction of the identity of the experimental philosopher takes place in a social sphere under construction: The Royal Society. Every new institution requires that new roles be defined. Academic institutions could not provide an adequate model because they were devalued in seventeenth century England. The figure of the scholar was in frank opposition to what a gentleman was considered to be. The members of The Royal Society, all of them gentlemen, could not see their participation in the institution in terms of the scholar, but nor did they consider that it derived from their quality as gentlemen. Robert Boyle presented himself as a model of an experimental philosopher. Boyle's identity was a collective practice that was shaped by respecifying and reevaluating the existing repertoires of the gentleman and the virtuous Christian. Both roles shared the traits of integrity and independence. The gentleman was obliged by the code of honor to be a spokesman for the truth and not to lie to another gentleman. His ancestry and economic position granted him free action as a defining characteristic. The

Christian, on the other hand, did not accept the authority of other human beings, so he had to be an active witness of what he conceived to be true. The Scriptures themselves urged him to tell the truth (Shapin, 1994). The transfer of these virtues to the identity of the experimental philosopher would make it possible to connect the moral order with the order of knowledge: moral virtues would be the foundation of trust, and the latter would constitute an ineliminable component of the generation of knowledge:

> The experimental polity was said to be composed of free men, freely acting, faithfully delivering what they witnessed and sincerely believed to be the case. It was a community whose freedom was responsibly used, and which publicly displayed its capacity for self-discipline (Shapin and Schaffer, 2011, p. 339).

At the same time, the rules of conduct of the gentleman were transferred to that of the experimental philosopher. The handling of the body of the experimental philosopher was involved in the recognition of their "trust and honour developed through the face-to-face interactions of this patrician culture were immensely dependent on the apparently trivial and superficial marks of comportment and behaviour" (Schaffer, 1992, p. 330). Cultural repertoires that carried vocabularies for talking about the bodily processes of knowledge-making made available the resources for constructing "the embodied portrayal of disembodied knowing" (Shapin and Lawrence, 1998, p.4). Boyle appealed to the persistent resource of the ascetic figure, who causally associated different bodies with the qualities of minds. Contemporary commentators on Boyle stressed the cultural significance of his disengagement, abstinence and physical delicacy (Shapin 1998). The disembodiment of the experimental philosopher and of the knowledge he produced became a cultural institution, sustained by the practices: "what we think about bodily boundaries, and transactions across them, is embedded in thought about and practices organized around, social boundaries and social transactions" (Shapin and Lawrence, 1998, p. 8), including the boundaries of science.

Another approach to the bodies of experimental philosophers juxtaposes the tension between solitude and public life with the transit of knowledge through the private and public places of the laboratory. These relationships allowed the configuration of games of visibility and invisibility, which had a strong epistemic-ethical-social meaning: we have, on the one hand, bodies that are made invisible in visible spaces to deny them the power to bear witness, on the other hand, visible bodies that are confined in hidden spaces to be recognized as knowledge-makers.

Let us see how this juxtaposition was constructed by linking bodies, trust and physical spaces. The legitimacy of experimental knowledge depended on the presence of the public in

some scene of the construction of knowledge. In this sense, the preparation of the staging of the experiment constituted a fundamental device to sustain trust in the experimental philosopher:

> Here evidence is treated both as the result of certain theatrical rituals through which the person of the experimenter was integrated into public performances, and also as the result of the accreditation of experimenters' stories by the public community of natural philosophy (Schaffer, 1992, p. 329).

Now, every performance has its hidden regions and these may correspond to divisions of space. The space where the first stages of the research took place, the back region, had to be private. In contrast, at the weekly meetings of the Royal Society, the experiments were displayed and discussed in a space, the front region, which was conceived as public – Shapin (1991) makes clear allusion to Erving Goffman's analysis of the notions of back and front regions. The public exhibitions were not simple reiterations of the events that had taken place in the private space: "they were demonstrations of ideal experiments, made ready to be displayed in public through endless private work devoted to making their phenomena docile, amplifying their read-out, and routinizing their performance" (Shapin, 1991, 207). However, since experimental tests could and usually did fail, the public had to be kept away from any uncertainty in obtaining the experimental fact. This is why experimental trials were carried out in relatively private places. Any accidental intrusion into the reality behind the scenes could have a powerful capacity to destroy what was promoted in the visible region.

Thus, the trope of solitude is incorporated into the experimental form of life as a retreat, often linked to work, although not entirely, which is interrupted by the presentation of the experiments in public. It was configured as a body-place traversed by ethical virtues and epistemic values. On the one hand, it was a space for the generation of knowledge: the truth is discovered, removed from the conventions, interests and distortions of civil society; on the other hand, it was a body, whose isolation, self-absorption and self-denial exhibited the value of the activity it carried out. The cultural resource that redefined and re-legitimized solitude was religious seclusion, which was erected as an instrument to protect back region:

> scientific discovery -empirical or mathematical - might proceed along the same channels as religious enlightenment. [...] And if the object of scholarly gaze was a divine Book of Nature, then the same sorts of understandings that were traditionally available to appreciate the religious recluse could also be drawn upon to establish the natural philosopher's identity as "nature's priest"[...] (Shapin, 19991, p. 206).

Instead, the justification of knowledge took place in the main hall and required an experimental audience. However, the stage required not only a gentlemanly audience but also other bodies working and even circulating between public and private places. The presence of technicians and assistants at the presentations was of vital importance, because Boyle did not intervene in the manipulations of the experimental apparatus. However, "Boyle's host of «laborants», «operators», «assistants» and «chemical servants» were invisible actors. They were not a part of the relevant experimental public. They made the machines work, but they could not make knowledge" (Shapin, 1988, p. 395). Their lack of economic independence –their status as wage earners– made it impossible for them to be credible witnesses. They were not present in the experimental scene "in roughly the same way, and for roughly the same reasons, that allowed Victorian families to speak in front of the servants. [...] If they told what they heard to other servants, it did not signify; and if they told it to gentlemen, it would not be credited (Shapin 1988, p. 395). The boundaries of experimental knowledge are also shaped by the political relations between employers and assistants. The moral order of the laboratory was founded on an economy of trust and power relations (Shapin, 1994). Their invisible bodies matter in constructing credible knowledge.

Let's look at one last approximation. As we know, matters of fact served as the foundation of knowledge to the extent that they were not seen as mere artifacts produced by human beings. The bodies of experimental philosophers were disciplined to shape matters of fact into given elements. Their work was equipped with instrumentation technologies, literary resources and a social organization. Experimenters' bodies were integrated into collective bodies of practitioners (Schaffer, 1992). The trust in the word of the experimental philosopher, as a modest gentlemanly witness, traced the limits of a moral-epistemic order. Furthermore, the confidence and self-knowledge of the experimental philosopher allowed him to go a step further and turn his body into a suitable matter of fact to obtain knowledge and evidence:

> They blinded themselves with sunlight, gassed themselves into states of ecstasy and insensibility, and electrified their limbs into paralysis or spasm. In celebrated episodes of the 1660s, for example, Isaac Newton poked brass plates and bodkins between his eyeball and the bone to test the relation between will and vision; Arthur Coga, a 'very freakish and extravagant' Cambridge divinity student, was paid a guinea so that fellows of the Royal Society could transfuse twelve ounces of sheep's blood into his veins, and in return presented them with a Latin account of his experience (Schaffer, 1992, p. 329).

According to the analysis of the two previous approaches, the body is constituted as the body of the experimental philosopher in the same process in which knowledge is constituted on the basis of matters of fact. The practices of experimental philosophers establish new uses of cultural resources and produce movements in the establishment of the limits of knowledge. However, the latter approach allows us to think of the body, not as being constituted by knowledge, but as constitutive of knowledge. The practice of knowledge on the same body seems to enable a shift in the questions: from the question of how the body of the experimental philosopher is constructed at the same time that knowledge is generated to the question of what the body of the experimental philosopher is when it is generated as evidence in the process of making knowledge. All in all, the body of the experimental philosopher is a social institution and as such it is analyzed in terms of the practices of interrelation, that is, something created collectively through self-referential practices; something subject to the dynamics of finitism and not the result of the mere performativity of language.

Final Considerations

The materiality of the body is unavoidable in the analysis of linguistic and non-linguistic practices of knowledge generation and justification. The intervention into and manipulation of devices, instruments and objects in places of experimentation not only impacts on the materials that make them up, but the blows and the movements made rebound and impact on the body of the experimenter who delivered them. Acts of argumentation, persuasion and argumentative dispute require bodily gestures and manners, that is, the management of the body of knowledge-makers is involved in the establishment of trust and in the very constitution of matters of fact. The materiality of the bodies of philosophers, objects, instruments and devices, language practices, practices of knowing, practices of experiencing and matters of fact are (re)constructed together.

Shapin and Schaffer's examination of the experimental philosopher's body covers a variety of topics that reveal how the body is constituted at the same time as knowledge is generated: the creation of the philosopher's identity as part of the limits of the experimental form of life, the disciplining of epistemic skills, the distribution of places that separate the generation of science from its public display and that make bodies simultaneously visible and invisible, public performances with theatrical rituals that bring matters of fact to the surface, the modelling of the philosopher's own virtue in consonance with a self-absorbed and disembodied body, and the valuation of experimental knowledge based on the negation of the body. Schaffer even goes a step further and notes how the body of the experimenter is constituted as an object and as evidence in the course of knowledge generation.

In all these processes, the cultural resources of gentlemanly society constituted the conditions of possibility for knowledge of the natural world. In the sense of language games, these resources act as exemplars through which the bodily practices and the body itself of the experimental philosopher and also that of his laboratory assistants are modeled. The commitment to the primacy of practice accounts for these links.

The priority of practice is based on ostension, through which the exemplars operate. In this way, the cultural resources available in gentlemanly society were learned, and that is why the analysis of *Leviathan* draws on courtesy literature: etiquette handbooks, practical ethical texts, books of manners. The authors do not assume that they can reconstruct the behaviour of early modern English gentlemen through these books. Rather, through courtesy literature and related texts, they seek to recover a set of repertoires of what was considered good and bad, decorous and indecorous, in gentlemanly conversation.

However, the set of examples used in such ostensive learning is always finite. Learners form dispositions to apply expressions about the body or bodily practices to a new case, such as the body of the experimental philosopher, on the basis of the learned examples. But there is nothing prior to the application practices that determines how to establish the similarities and differences between the set of exemplars and the new cases that have been encountered. The transfer of the qualities of the gentleman and the virtuous Christian to the experimental philosopher and the configuration of his ascetic and solitary body is rooted in situated contingencies, physiological dispositions, and the world, but its legitimation involves the community and the concordance of its practices in a language game. Thus, in accordance with the dynamics of finitism, the applications of the cultural resources available in the seventeenth century that were used to configure the body of Boyle and the experimental philosophers, their virtues, and their identities have an open texture. The cultural repertoires that act as exemplars are also subject to change. There are no determinisms.

The tension between language and materiality remains a highly relevant problem for the historiography, philosophy and sociology of science. *Leviathan*'s historical narrative did not approach it as a dichotomy nor did it seek a reductionist response. As part of the linguistic turn, it focused on the primacy of practice and from there it reflected on science as a social construction, that is, a social institution that is governed by the logic of finitism. The constructivist perspective that *Leviathan* assumed made more complex what Ian Hacking characterized as contingency, nominalism and the stabilization of science, including them in the problems of rules and rule following.

However, Shapin and Schaffer considered that it is not only science that is created through a finitist dynamic, but rather also the writing and rewriting of the past. If we accept finitism, we can also consider knowledge of the past as a social institution informed by self-referential

practices. Past resolutions of our historiographical problems do not determine future applications. In this sense, the legacy of finitism and its validity for the historiography of science lies not only in explaining the open texture of historical narratives but in pointing out their discursive-material character.

References

BIAGIOLI, Mario. Tacit Knowledge, Courtliness, and the Scientist's Body. *In:* FOSTER, Susan Leigh (ed.). **Choreographing History**. Bloomington and Indianapolis: Indiana University Press. 1995, pp. 69-81.

BARAD, Karen. Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter. **Signs: Journal of Women in Culture and Society**, Chicago, v. 28, n. 3, pp. 801-831, 2003.

BARNES, Barry. On the Conventional Character of Knowledge and Cognition. **Philosophy of the Social Sciences**, Thousand Oaks, v. 11, n. 3, pp. 303-333, 1981.

BARNES, Barry. **T. S. Kuhn and Social Science**. Columbia: Columbia University Press. 1982a.

BARNES, Barry. On the Extensions of Concepts and the Growth of Knowledge. **Sociological Review**, Lancaster, v. 30, pp. 23-44, 1982b.

BARNES, Barry, BLOOR, David and HENRY, John. **Scientific Knowledge**: A Sociological Analysis. Athlone and Chicago: Chicago University Press, 1996.

BLOOR, David. **Wittgenstein***:* Rules and Institutions. London: Routledge, 1997.

BLOOR, David. Critical Notice. **Canadian Journal of Philosophy**, Cambridge, v. 30, n. 4, pp. 597-608, 2000.

BLOOR, David. Wittgenstein and the priority of practice. *In:* KNORR CETINA, Karin, SCHATZKI, Theodore R. & VON SAVIGNY, Eike (eds.). **The Practice Turn in Contemporary Theory**. New York: Routledge. 2001a, pp. 95-107.

BLOOR, David. What is a Social Construction? **Facta Philosophica**, Charlottesville, v. 3, n. 2, pp. 141-156, 2001b.

HACKING, Ian. Artificial Phenomena. **The British Journal for the History of Science**, Cambridge, v. 24, n. 2, pp. 235-241, 1991.

HACKING, Ian. Statistical language, statistical truth and statistical reason: The self-authentication of a style of scientific reasoning. *In:* MC MULLIN, Ernan (ed.). **The Social Dimensions of Science**. Notre Dame, Ind.: University of Notre Dame, 1992a, pp. 130-157.

HACKING, Ian. The Self-Vindication of the Laboratory Sciences. *In:* PICKERING, Andrew (ed.). **Science as Practice and Culture**. Chicago: Chicago University, 1992b, pp. 29-64.

HACKING, Ian. **The Social Construction of What?** Cambridge, Mass: Harvard University Press, 1999.

HACKING, Ian. **Véracité et raison**. Cours au Collège de France. Paris: Collége de France, 2006. Available *In:* http ://www.ianhacking.com/collegedefrance.html. Accessed 10 July 2024.

HACKING, Ian. **Scientific Reason**. Taiwan: National Taiwan University, 2009.

HACKING, Ian. 'Language, Truth and Reason'. Thirty years later. **Studies in History and Philosophy of Science**, Amsterdam, v. 43, n. 4, pp. 599- 609, 2012.

KUSCH, Martin. Metaphysical deja vu: Hacking and Latour on science studies and metaphysics. **Studies in History and Philosophy of Science**, Amsterdam, Part A, v. 33, n. 3, pp. 639-647, 2002a.

KUSCH, Martin. **Knowledge by Agreement**: The Programme of Communitarian Epistemology. Oxford: Oxford University Press. 2002b.

LATOUR, Bruno. Postmodern? No, Simply Amodern! Steps Towards an Anthropology of Science. **Studies in History and Philosophy of Science**, Amsterdam, v. 21, n.1, pp. 145-171, 1990.

LATOUR, Bruno. **Nous n'avons jamais été modernes**: essai d'anthropologie symétrique. Paris: Editions la Decouverte,1991.

LATOUR, Bruno. Review Essay: The Netz-Works of Greek Deductions. **Social Studies of Science**, Thousand Oaks, v. 38, n. 3, pp.441-459, 2008.

MARTÍNEZ RODRÍGUEZ, María Laura. **Texture in the Work of Ian Hacking**. Michel Foucault as the Guiding Thread of Hacking's Thinking. Cham: Springer Verlag, 2021.

MARTINI, María de los Ángeles. Ian Hacking's rewriting of *Leviathan and the Air-Pump*. **Transversal**: International Journal for the Historiography of Science, Belo Horizonte, n. 15, pp. 1-16, 2023.

PENELAS, Federico. **Wittgenstein**. Buenos Aires: Galerna. 2020.

SCHAFFER, Simon. Self Evidence. **Critical Inquiry**, Chicago, v. 18, n. 2, pp. 327–62, 1992.

SCHAFFER, Simon. Opposition is True Friendship. **Interdisciplinary Science Reviews**, London, v. 35 n. 3-4, pp. 277-90, 2010.

SHAPIN, Steven. The House of Experiment in Seventeenth-Century England. **Isis**, v.79, pp. 373-404, 1988.

SHAPIN, Steven. The Mind is Its Own Place: Science and Solitude in Seventeenth-Century England. Cambridge. **Science in Context**, v. 4, pp.191-218, 1991.

SHAPIN, Steven. Discipline and Bounding: The History and Sociology of Science as seen through the Externalism-Internalism Debate. **History of Science**, Thousand Oaks, v. 30, pp. 333-369. 1992.

SHAPIN, Steven. **A Social History of Truth**. Chicago: Chicago University Press. 1994.

SHAPIN, Steven. Placing the View from Nowhere: Historical and Sociological Problems in the Location of Science. **Transactions of the Institute of British Geographers**, n. 23, 1998a. p. 5-12.

SHAPIN, Steven. The Philosopher and the Chicken: On the Dietetics of Disembodied Knowledge. *In:* SHAPIN, Steven and LAWRENCE, Christopher (eds.). **Science Incarnate**: Historical Embodiments of Natural Knowledge. Chicago: University of Chicago Press, 1998b. p. 21-50.

SHAPIN, Steven. Rarely pure and never simple: Talking about truth. **Configurations**, Baltimore, v. 7 n. 1, 1999. p. 1-14.

SHAPIN, Steven. **Never Pure**: Historical Studies of Science as if It was Produced by People with Bodies, Situated in Time, Space, Culture, and Society, and Struggling for Credibility and Authority. Baltimore: The Johns Hopkins University Press, 2010.

SHAPIN, Steven and LAWRENCE, Christopher (eds.). **Science Incarnate**: Historical Embodiments of Natural Knowledge. Chicago: University of Chicago Press, 1998.

SHAPIN, Steven and SCHAFFER, Simon. **Leviathan and the Air-Pump**: Hobbes, Boyle, and the Experimental Life. Princeton: Princeton University Press, 2011.

SISMONDO, Sergio. Some Social Constructions. **Social Studies of Science**, Thousand Oaks, v. 23, n.3, pp. 515-553, 1993.

Additional Information

Academic biography

María de los Ángeles Martini holds a PhD in Epistemology and History of Science (UNTREF). She is an academic researcher specialized in the field of Science Studies. Martini's longstanding research interests focus on the Historiography of Science, particularly the work of American historian Steven Shapin. Her interest centers on the co-production of scientific knowledge: the simultaneous processes through which the epistemic, the social, and the natural are configured both in the past and in the present.

Contact address

Deparment of Sociology, UBA. Santiago del Estero 1029, Office 137, 1st floor, Ciudad Autónoma de Buenos Aires, C1075AAU, Argentina.

Funding

Universidad de Buenos Aires. UBACyT2023 20920250100366BA. Universidad Nacional de Moreno. PICyDT UNM X-2024. UNM-SDI 48/24.

Conflict of interests

No conflict of interest has been declared.

Ethics Committee approval

Not applicable.

Preprints

The article is not a preprint.

Availability of research data and other materials

Not applicable.

Editors

Copyright

Editorial Review History

Submission date: 13/03/2025
Approved for publication: 29/07/2025

License