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Henri Fayol and Claude Bernard's experimental method

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Abstract

The article aims to analyze the relationship between Fayolism and Claude Bernard's experimental method, a method Fayol argued to be based on for the elaboration of his magnum opus. The study used the history of administrative science methodologically based on the internal analysis of the authors' texts. The findings suggest divergences between Fayolism and the experimental method, besides evidence of the period of Fayol's itinerary in which he would, in fact and belatedly, have had direct contact with Bernard's work. The main conclusion is that there is strong evidence to suggest that Fayol did an unsystematic study of Bernard and only really proceeded with the study after 1916, the year of his main work, and could not have practiced the method to which he said he adhered.

Keywords: Henri Fayol. Experimental method. Claude Bernard. History of administrative science.

Henri Fayol e o método experimental de Claude Bernard

Resumo

O objetivo do artigo é analisar a relação entre o fayolismo e o método experimental de Claude Bernard, em que o próprio Fayol argumentou estar fundamentado para a elaboração de sua obra magna. A abordagem utilizada foi a história da ciência administrativa metodologicamente baseada na análise interna dos textos dos autores. A pesquisa sugere divergências entre o fayolismo e o método experimental, além de evidências do período do itinerário de Fayol, no qual teria, de fato e tardiamente, tomado contato direto com a obra de Bernard. A conclusão principal é que são fortes as evidências que sugerem que Fayol fez um estudo pouco sistemático de Bernard e só procedeu de fato ao estudo após 1916, ano de sua obra principal, de modo que não pôde ter praticado o método ao qual se disse aderente.

Palavras-chave: Henri Fayol. Método experimental. Claude Bernard. História da ciência administrativa.

Henri Fayol y el método experimental de Claude Bernard

Resumen

El objetivo del artículo es analizar la relación entre el fayolismo y el método experimental de Claude Bernard, método en el que el propio Fayol argumentó basarse para la elaboración de su obra magna. El enfoque utilizado fue la historia de la ciencia administrativa basada metodológicamente en el análisis interno de los textos de dichos autores. La investigación sugiere divergencias entre el fayolismo y el método experimental, así como evidencias del período del itinerario de Fayol en el que, de hecho y tardíamente, habría entrado en contacto directo con la obra de Bernard. La conclusión principal es que hay pruebas sólidas que sugieren que Fayol hizo un estudio poco sistemático de Bernard y que sólo procedió efectivamente a su estudio después de 1916, año de su obra principal, por lo que no pudo haber practicado el método al que afirmaba adherirse.

Palabras clave: Henri Fayol. Método experimental. Claude Bernard. História da ciência administrativa.

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"[It is an] orderly unfolding of a practical thinking driven by some broad general ideas"
(Maxime Leroy, in 1917, on the Fayolist doctrine).

INTRODUCTION

Henri Fayol's ideas about management are well known in the field and have become enshrined in the most widely read literature as part of a classical, mechanically inspired approach. Even the most auspicious commentators have taken this position, as in Morgan (1996). However, a closer reading of *General and Industrial Management* (Fayol, 1931, 1964), of 1916, yields countless different impressions, particularly in terms of the place and importance of biology in the author's main book.

This has a number of implications, especially if we consider aspects related to the scientific method. In studies on the presence of biology in Fayolist thought (Peaucelle, 2000; Peaucelle & Guthrie, 2013), there are many indications of connections with Claude Bernard (1949) and his book, *Introduction à l'étude de la médecine expérimentale*, of 1865. The indications always suggest that Fayol harbored a deep admiration for the physiologist. Fayol himself (1927a) acknowledged as much in specific passages in *L'éveil de l'esprit public*, first published in 1918. In this work, there is a notable attempt to establish an "experimental management" based on the "experimental medicine" inspired by the French physiologist.

Claude Bernard, in turn, received many commendations from his contemporaries, as well as after his death (Virtanen, 1960). Bergson (1969, p. 125) made a remarkable statement in a 1913 speech on the centennial of Bernard's birth, declaring that the celebrated 1865 book was, for his contemporaries at the beginning of the century, what Descartes' *Discourse on Method* had been for the seventeenth and eighteenth centuries.

Bernard's ideas thus crossed the Atlantic. The concept of the "internal environment" (*milieu intérieu*) of an organism laid the foundation for Cannon (1932) to develop the idea of homeostasis and its far-reaching implications beyond biology. As he himself wrote, "[i]t was the great French physiologist, Claude Bernard, who first suggested that a highly important factor in the establishment and maintenance of steady states in the body is the internal environment" (Cannon, 1932, p. 37), later adding that the French author "saw that the preservation of constancy is the condition for free and independent life" (Cannon, 1932, p. 249).

Bernard's ideas also reached Lawrence Henderson at Harvard, with wide-ranging effects in the 1920s and 1930s. Henderson (1949), who also had a background in the natural sciences and was interested in advances in physiology and sociology, wrote the introductory text for the 1927 translation of Bernard's *Introduction* in the United States. More importantly, the idea of the "internal environment" contributed to the development and consolidation of the concept of the "social system," which presupposes the mechanisms of equilibrium. Henderson (1935) also extended the parallels between Pareto, Cannon and Bernard using these very components. He wrote the following:

> Pareto observes that the state of the social system is determined by its conditions. Therefore, if a small modification of the state of the system is imposed upon it, a reaction will take place and this will tend to restore the original state, very slightly modified by the experience (Henderson, 1935, p. 46).

After considering that these aspects are widely known, Henderson (1935) suggested that the "case of physiological equilibrium is similar. In fact, it is logically identical. [...]. Claude Bernard's discussion of the constancy of the *milieu intérieur* bears on the same point, and so do[es] Cannon's recent discussion of homeostasis" (Henderson, 1935, p. 46). At Harvard, Henderson also laid the groundwork for the acceptance of "system" and "equilibrium," transposing these concepts to the social plane, and not without the direct influence of Bernard's physiology (Russett, 1966). This way of approaching society and organizations had extraordinary importance for Parsons, Mayo, and Barnard, to name only a few (Heyl, 1968). Together with Elton Mayo (Henderson, Whitehead, & Mayo, 1937), he developed the laboratory for fatigue studies and applied the experimental method beyond the walls of Harvard, reaching Hawthorne, as well as studies in anthropology and industrial psychology (Baritz, 1960). It could even be said that Bernard's physiology is the basis of the theory of organizations developed in those years at Harvard, demonstrating the importance of this author beyond physiology.

Before Harvard, however, Fayol had already transposed elements from physiology to management, allegedly under the influence of Bernard. It is easy to concede that grounding an "experimental management" in Bernard's physiology would offer visibility and acceptance in both the circles of practical agents and beyond. It is no surprise that in *L'éveil de l'esprit public,* Fayol (1927a) declared that he was a "fervent disciple" (Fayol, 1927a, p. 4) of the positive (Comte) and experimental (Bernard) methods. His collaborators did not hesitate to reaffirm this association, from the most restrained (Vanuxem, 1927) to the most exuberant (Verney, 1925).

Nevertheless, such a textually explicit adherence does not appear in Fayol's main work of 1916, *General and Industrial Management*. The only passage in this book used by Fayol and his collaborators to establish the association with the experimental method is open to discussion, as we will see below. It is only after 1918 that this direct adherence and association are claimed and disseminated in writing. This does not mean that prior to 1918, there were not elements transposed from biology and certain aspects that belonged to the scientific method as well as ample references to practical experience as a manager. Much to the contrary, the imprints of biology and the demands for a systematic management had been in place since at least 1900 (Fayol, 1931, 1964). However, the fact that the adherence and association is only established after 1918 is intriguing enough to suggest that the embrace of Bernard's experimental method was not comprehensive during the years leading up to the main text of 1916, which indeed enshrined Fayolism.

With regard to these scientific aspects, general critiques have already been levied against the broader "classical" movement in which Fayol is often situated, particularly concerning the lack of rigor and the excess of empiricism (March & Simon, 1970). However, what would have transpired between the claim of Fayolism's adherence to Bernard's experimental method and what was actually accomplished has not yet been properly considered. This is a gap that must be addressed.

Accordingly, the objective of this investigation was to analyze the relationship between the Fayolism devised by the pen of Henri Fayol and Claude Bernard's experimental method. The pursuit of this aim is justified insofar as it contributes to a history of management science interested in the general processes that involve the acquisition of knowledge, particularly by a practical and theoretical agent whose trajectory is inextricably bound up with the very development of the field of management and of studies about organizations. In the figure of Fayol, the practical and the theoretical are intertwined, insofar as he was someone who was at the head of a large French corporation and, at the same time, theorized about reality and disseminated his ideas, with a significant influence beyond France. As such, analyzing the relationship between Fayolism and the experimental method conceived in the nineteenth century can shed light on the epistemological problems involved and reveal the historical significance of those problems.

In theoretical and methodological terms, the research was concerned with Fayol's epistemological itinerary, that is to say, the path that reflects the tradition in which the author was situated and the legacies he inherited from it, as well as the procedure adopted for the investigation that underpinned his fundamental propositions. The approach developed for this end makes reference to the materialism that focuses on the studies of ideal formations, including management thought (Paço-Cunha, 2020, 2021; Paço-Cunha & Guedes, 2016). The materialist approach mobilized in the present endeavor in the history of management science satisfies the requirements of historical objectivity and realism (Bunge, 2006; Cardoso & Brignoli, 1983), as an established alternative to the now predominant—but not always stated—relativist tendency in historical studies in management and organizational studies (Coraiola, Barros, Maclean, & Foster, 2021). In the materialist approach in question, ideal formations are not autonomous, nor do they have a history of their own. On the contrary, they are bound up with the concrete-historical conditions that make them possible, have practical roots, and spill over into the very conditions that enabled them, producing different effects in different directions—sometimes in contradiction to the stated ambitions. The epistemological itinerary does not occur, therefore, as an autonomous movement on the plane of ideas. We argue, however, that it is possible to provisionally refrain from analyzing the concrete-historical conditions themselves in order to highlight the internal problematics of a particular itinerary, setting aside a deeper analysis until a more opportune and focused moment.

Additionally, and in procedural terms, the historical account of Fayol's epistemological itinerary focused, above all, on an "immanent analysis" of the author's texts. We followed the analytical approach adopted in the study of management thought (Paço-Cunha, 2015, 2020, 2021), in which the argumentative structures, correspondences and contradictions are themselves considered. For the present case, Bernard's text was also discussed for comparative purposes. Since, as argued, we refrained from examining the concrete-historical conditions in order to focus on the internal problematic of the epistemological itinerary, the analysis carried out below does not intend to perform an immanent critique per se, already partially undertaken by other studies of Fayolist thought (Paço-Cunha, 2021).

The article is thus divided into four parts in addition to this introduction. In the first part, we will specifically address the difference between Bernard's experimental method and what Fayol claimed in order to clarify his adherence to that method. In the second part, we will explore the chronological aspect of the relationship between Fayol and the experimental method, suggesting the period of the author's itinerary in which his study of Bernard would have taken place. In the third part, we will consider the more circumscribed nature of Fayol's procedure for conducting his studies based on practical-administrative everyday life, differentiating it from Bernard's experimental method. Lastly, we will present the article's final considerations.

EXPERIMENTAL METHOD WITHOUT EXPERIMENT

The earliest text by Fayol (1931, 1964) to which the public has access dates from 1900, when he gave a speech at the metallurgical congress. Fayol had already achieved considerable prestige for a number of reasons. One of them, undoubtedly, was due to the chemical experiments conducted at the mine and mill he managed (Fayol, 1918), in addition to having authorized fossil surveys on their premises (Brongniart, 1893; Renault & Zeiller, 1888). In this speech, Fayol insisted that he was not concerned with managerial aspects, which was reflected in discussions at the congress, which did not touch on the pressing business concerns of the time.

In this context, addressing the subject of management, he used a "comparison with physiology." (Fayol, 1964, p. 152). Anticipating by 16 years what would be said later, our author argued that the "nervous system in particular bears close comparison with the managerial function. Being present and active in every organ, it normally has no specialized member and is not apparent to the superficial observer." We then read that "the body corporate, like the animal, has its reflex responses or ganglia which take place without immediate intervention on the part of the higher authority" (Fayol, 1931, p. 163, 1964, p. 152).

Sixteen years later, Fayol would deepen this foundation in physiology at different points in his main work. As he went on to repeat, the "nervous system in particular bears close comparison with the managerial function" (Fayol, 1964, p. 85). The presence of this foundation is so extensive as to make it possible to observe that the social organization, in the form of the company or the state, is understood through an analogy with the living organism, in which the "[m]an in the body corporate plays a role like that of the cell in the animal" (Fayol, 1964, p. 85). It is no surprise that it has been argued that the identification of the functions (commercial, technical, security, financial, accounting and management) and, therefore, the corresponding capacities is based on an analogy with the organs, systems and functions as described in the physiology of living beings (Paço-Cunha, 2021). This is reinforced by the fact that Fayol collaborated with his son-in-law Désaubliaux to write *Les origines biologiques de la fonction administrative* (Breeze, 2002, p. 87), whose title helps to set the tone of the endeavor. Between 1917 and 1918, this general framework is confirmed by the repetition of the central ideas and by the further addition that he was convinced that "social phenomena are subject, like physical phenomena, to natural laws independent of our will" (Fayol, 1927a, p. 2), and not incidentally, he also acknowledged the existence of "administrative diseases" for which a remedy and a cure would be sought (Fayol, 1927b, p. 33, p. 48). More explicitly, we read that

> A *manager* dealing with the body corporate has the same concerns as a *physician* dealing with the human body. Both seek to "build healthy organisms, conserve health and cure diseases." It is no wonder, then, that the method that suits the physician when dealing with individuals, also suits the administrator dealing with bodies corporate (Fayol, 1927a, p. 2).

In 1921, certain elements are still present, albeit more diluted, perhaps due to the substance of the debate highlighting the congenital limitations of the state in economic management (Fayol, 1921). While the imprints of physiology and medicine are constant throughout Fayol's intellectual production, the same cannot be said unreservedly about Bernard's experimental method. There is no strong evidence prior to 1918, as stated above. In general, the adherence and association between Fayolism and Bernard are visible, in retrospect, in a passage taken from *General and Industrial Management*, of 1916, in which we can read that:

> Method consists of observing, collecting and filing facts, interpreting them, trying out experiments if need be, and from the study as a whole, deducing rules which, under the management's impetus, may be introduced into business practice. Most developments that have raised business science to its present level emanate from this same method, which in actual fact is none other than the Cartesian one (Fayol, 1927b, p. 268, 1931, p. 90, 1964, p. 90).

Fayol emphasized this passage in 1918 as an example of the experimental and Cartesian method. He said that

> Management has thus far evaded the experimental method, as medicine did until Claude Bernard. However, there is no doubt that most of the developments that have raised business science to its present level emanate from this same method, which is none other than the Cartesian one (Fayol, 1927b, p. 268).

More than once he signaled that his working method, following Bernard, was to employ "observation, experience and reasoning" (Fayol, 1927a, p. 2), expressing a "positive management" as opposed to an "empirical management" because the former would be supported, let us repeat with the author, by "observation, experience and reasoning" (Fayol, 1927b, p. 268). His collaborator, after quoting that central passage, asked, "Is this not the entire experimental method, defined in terms that *Claude Bernard* would not deny?" (Vanuxem, 1927, p. 135).

There are some issues to be considered that help to answer this question in the negative.

First, the passage used by Fayol and his collaborator to establish the adherence to and association with the experimental method is found in Chapter II of the 1916 book, on the elements of management, in which the specific subject is the constitution of the body corporate, in particular the general management, which has "the responsibility […] to conduct the enterprise toward its objective", i.e., "[i]t is the executive authority" (Fayol, 1964, p. 88). Among the many duties of the general management is the "search for improvements" (Fayol, 1964, p. 90). It is because of this duty that Fayol introduced the crucial passage for him and his collaborators that seeks to establish the connection with Bernard. We observe, however, that the method is used for the "search for improvements" in the context of its presentation as a duty of the general management and not—which is curious—as a foundation for Fayol's arrival at his principles and rules (division of work, authority, hierarchy, etc.); that is, it was not presented as the scientific trajectory of Fayol himself.

A second important issue is the explicit reference, in the context of the passage, to the correspondence with Descartes; as Fayol wrote in the paragraph immediately following the passage, "[m]ost developments that have raised business science to its present level emanate from this same method, which in actual fact is none other than the Cartesian one" (Fayol, 1964, p. 90). Why "Cartesian method" and not "experimental method"?

This point makes it necessary to consider Bernard's proposition regarding his method. A reading of the key text suggests considerable influence from Descartes with regard to "Cartesian doubt" because as Bernard wrote, the "great experimental principle, then, is doubt, that philosophic doubt that leaves to the mind its freedom and initiative and from which the virtues most valuable to investigators in physiology and medicine are derived" (Bernard, 1865, p. 66, 1949, p. 37). However, all of Bernard's efforts to develop the experimental method cannot be reduced to Cartesian doubt, and if that were true, then the pure and simple repetition of Descartes would suffice, which was not the case. In short, there is no pure identity between the "experimental method" and the "Cartesian method," not to mention that Fayol did not consider "doubt" with the same intensity as Bernard; in truth, it is difficult to find anything with a similar weight in the Fayolist doctrine that fulfills the function of "philosophical doubt" in Bernard's experimental method, except perhaps for "sense of proportion," as we will see later, but in a particular respect so as to widen the distance between Fayol and the physiologist.

As a third issue, Fayol proceeded through identification. Our author even wrote that he followed the "method that is recommended by Auguste Comte under the name of the *positive* method; by Claude Bernard, under the name of the *experimental* method, and which I considered *scientific*, as I was supported by the principles of Descartes." (Fayol, 1927a, p. 2). For Fayol, the positive, experimental and Cartesian methods are the same thing under different names. However, if there is no pure identity between Bernard and Descartes, there would be still less between the former and Comte, as the physiologist's 1865 text fueled considerable hostility toward Comtian positivism, due to its systematizing tendencies based on logical derivations and an excessive belief in reasoning (Bernard, 1949, p. 37, p. 221). Indeed, a careful reading of the text leads to the conclusion that "Bernard is a positivist only in a vague and general sense" (Virtanen, 1960, p. 63). Thus, for Fayol, every position that evokes some scientific requirement could be identified as different names of the same thing, albeit in a superficial reading.

There is also a fourth important issue, in reference to the discrepancies between Fayol and Bernard. We can focus on those that are essential. As seen above, in the central passage that is intended to convey adherence to and association with the experimental method, we read Fayol's recommendation to carry out "experiments if need be" (Fayol, 1927b, p. 268). It is important to underscore the notion of a potential necessity. In contrast to Bernard, for whom the experimental method

is crucial and the core of the scientificity of physiology and medicine, Fayol suggests that experiments may be carried out under certain circumstances that make them necessary. This is no small thing. Fayol seems more attentive to the observation, collection, classification and interpretation of facts. By contrast, for Bernard, the scientificity of physiology and medicine would be based on the experimental method, i.e., it is always necessary; it is even a condition. Fayol's experimental path seems to emphasize observation, while Bernard called for going far beyond the most empirical moment. For him, the "true experimental method consists in a logical union of empiricism and experimentation," as the former "is nothing but the first step of the experimental method." Thus, "empiricism cannot be a final stage, the vague, unconscious experience, which may be called medical tact, is later transformed into a scientific idea, by the experimental method that is conscious and logical" (Bernard, 1949, p. 210). In this vein, it is possible to see the difference between operation and emphasis. Fayol is adherent, as we have already indicated, to the operative that consists of "observation, experience and reasoning." There is, in this adherence, an emphasis on reasoning, for he advocates the "immediate and rigorous application of reasoning to the facts that observation and experience furnish" (Fayol, 1927a, p. 3). Curiously, the passages from Bernard quoted by Fayol (1927a, pp. 3-4) in 1918 say something different. For Bernard, the operative, indeed reciprocal connections between factors can be observed in the relationship among "sentiment, reason and experiment":

> Thus, in the natural progress of things, appeared the experimental method that includes everything and that [...] leans successively on the three divisions of that unchangeable tripod sentiment, reason and experiment. In the search for truth by means of this method, feeling always takes the lead; it begets the *a priori* idea or intuition, and reason or reasoning develops the idea and deduces its logical consequences. But if feeling must be clarified by the light of reason, reason in turn must be guided by experiment (Bernard, 1949, p. 28).

We can easily see the difference between the "observation, experience and reasoning" of Fayol and "sentiment, reason and experiment," in which the emphasis is placed on experiment in the latter rather than on reasoning, as in the former. The overall comparison produces the impression of striking differences, as Fayol seems adherent to observation and reasoning, while Bernard places a crucial emphasis on experiment, albeit with reciprocities between the factors.

On this point, there is still a fundamental question. Everything suggests that the more rigorous requirement of the experimental method when conducting experiments is presented in a diluted form in Fayolism and takes on a much less systematic and more expressive connotation of practical experience gained by a specific person, as we will explore further below. It is an experimental method without experiment, so to speak. It is experiment diluted by practical experience drawn from everyday administrative life. By way of example, Bernard explained that

> A physician observing a disease in different circumstances, reasoning about the influence of these circumstances, and deducing consequences that are controlled by other observations—this physician reasons experimentally, even though he makes no experiments. But if he wishes to go further and to know the inner mechanism of the disease, he will have to deal with hidden phenomena, and so, he will experiment, but he will still reason in the same way (1949, pp. 16-17).

The most systematic experiment is the step forward, the summit of scientificity in Bernard's view. The contrast with Fayol is striking, when the latter explained his general procedure. He wrote that "the principles and rules of management can be deduced from observation and experience, as can the principles and rules of any other science" (Fayol, 1927c, p. 11) applicable to all businesses. How was that experience — the basis for this deduction — obtained? He himself provided an answer, pages earlier:

> While closely observing the mining and metal industry, my attention was also drawn to businesses of all kinds as well as to the family and the state. Gradually, I came to recognize that certain management principles are applicable to all undertakings, whatever their nature, purpose and scale. It is from the grouping of these principles, rules and products that the doctrine set out in the first volume of these studies has emerged (Fayol, 1927a, p. 4).

His personal experience in the company he managed, based on everyday observation, served as the basis of a "recognition," for, shall we say, inferences regarding the state, for example, where he had no direct or systematic observation or personal experience per se, as was the case in the corporation he managed. Here, we see that the most constant element is inference based on observation being equated with personal experience. All this situates Fayol as very broadly associated with the experimental method and with an arguable adherence to it, perhaps paralyzed at the empirical moment of the method,

without taking the crucial step forward. It is thus possible to harbor doubts about the quality of the study that Fayol undertook of Bernard's *Introduction*. In Fayolist writing, there is no attempt to transpose and adapt the experimental method to "social phenomena" and no scrutiny in this regard. The field of management would witness something closer to the experimental method only through Bernard's influences felt in the Harvard-Hawthorne relationship, as we have noted above, but not without sharp critiques regarding the manipulative tendencies in practice (Baritz, 1960).

Fayol: belated reader of Bernard

When exploring the topic based on a comparison with essential elements, another equally intriguing question emerges: considering that Fayol did indeed study Bernard as a "fervent disciple," as the former claimed, when would this have occurred? One way to answer this question is to follow the clues left by Fayol in the preface of 1918, which contains certain autobiographical traces.

In it, Fayol (1927a) explained that he undertook his "personal education" for half a century without interruption, "constantly enlightened, guided and controlled by experience" (Fayol, 1927a, p. 2), in which these studies aided him in his professional duties until he reached his position as managing director. He explained that he began to be interested in "administrative facts" very early in his career, writing that he used the same method for the "study of facts of a material order, that is to say, observation, experience and reasoning" (Fayol, 1927a, p. 2). Far from being a systematic study, he wrote that "I learned, after a short time, that this method was admirably described by Claude Bernard in *Introduction to the Study of Experimental Medicine*" (Fayol, 1927a, p. 2). The manner and depth in which he then learned about it are not explained. Fayol then recommended that all those for whom "administration is of interest" should read Bernard's book, so that they can "use the experimental method," as they would find the work to be "a guide and a support" (Fayol, 1927a, p. 2). He added that he had in fact read Bernard, without mentioning when, and that it reinforced his conviction that "social phenomena are subject, like physical phenomena, to natural laws independent of our will" (Fayol, 1927a, p. 2) — while for Bernard, this transposition is not possible because strictly speaking, the "object of an experimental science is to discover the laws of natural phenomena" (Bernard, 1949, p. 197).

Nevertheless, further along the autobiographical path, Fayol added a crucial piece of information. He wrote that he was "satisfied in having instinctively followed the method that is recommended by Auguste Comte under the name of the *positive* method; by Claude Bernard, under the name of the *experimental* method, and that I considered *scientific*, as I was supported by the principles of Descartes" (Fayol, 1927a, p. 2). As further support, he later wrote that he was, "unknowingly, a fervent disciple" of Bernard (Comte and Descartes) and that he was "convinced of the excellence of the experimental method in the study of social questions" (Fayol, 1927a, p. 4).

Although there is no indication of dates in the autobiographical sketch, it is only after these considerations that Fayol mentioned what we have already pointed out: he deduced the principles from observation at the company he managed, and he inferred them for other types of enterprises, grouping the principles in the doctrine presented in his central work. The timeline and the dissimilarities we collected above may suggest that Fayol, if he was not merely a bad disciple, belatedly began a direct reading of Bernard after 1916 and that, therefore, the experimental method advocated by Bernard did not systematically inform the entire epistemological itinerary that culminated in the main Fayolist work from that year. After all, proceeding "instinctively" and becoming a "fervent disciple" "unknowingly" is not behavior that is in line with the requirements of the experimental method outlined by his master.

Add to that, also, a passage from *L'administration positive dans l'industrie* that fuels the problematic in question. Immediately after quoting the passage used to establish his adherence to and association with the "experimental method," he wrote that this "is the method that, from 1860 to the present, I have unceasingly applied both to the administrative facts that have unfolded around me and to those facts of a material order." (Fayol, 1927b, p. 268). According to the author, we are informed that he was applying the method deemed experimental even before the original publication of Bernard, in 1865, which would have inspired him. Lapses can also be symptomatic.

The belated claim of adherence to and association with the experimental method may perhaps be an expression of the need to disseminate Fayolism after 1916. Given the impact of the pivotal book of Fayolism that year as well as the founding of the Center for Administrative Studies in 1917, it was necessary for the doctrine to gain adherence from ideologues and practitioners in companies, the state and schools. Grounding Fayolism in the scientific method, even if it was a clumsy amalgamation of Descartes, Comte and Bernard, could be part of those claims to which the proper study of the latter was belatedly subjected.

The Fayolist é *prouvette*

As we suggested above, what for Bernard was found in the more systematic, practically laboratory experiment, was for Fayol more confined to practical experience at the company. Bernard was emphatic in saying that "[a]s experiments indeed are only judgments, they necessarily require comparison between two things, and the intentional or active element in an experiment is really the comparison that the mind intends to make" (Bernard, 1949, p. 10). He added, shortly after, that an "experimental science, or science of experimentation, is a science made up of experiments, i.e., one in which we reason on experimental facts found in conditions created and determined by the experimenter himself" (Bernard, 1949, p. 16). However, a laboratory was not available to Fayol for "social questions," and there are no indications that he conducted comparative experiments with the introduction, for example, of the principle of the division of work.

We know that Fayol carried out chemical experiments in a laboratory (Fayol, 1918). However, we have no evidence for "social questions." To a certain extent, the place of personal experience and the meaning of management actions are elements that reaffirm the tendencies we have already identified. "Experience," in Fayol's meaning, is the result of management practice in a laboratory of everyday administrative life, so to speak, in the figure of the company as a field of practical experimentation.

The division of work is a good example of this, although it does not encapsulate all the issues. Nevertheless, we accept that all organizations have some division of work. For Fayol, incidentally, the division of work is a characteristic of "nature" (Fayol, 1964, p. 30). We will be provisionally indulgent of this final point and accept that both company and state have a certain division of work. From the management point of view that Fayol developed, dividing work is an imperative that is, however, subject to circumstances and results. There is, along these lines, a degree of the division of work that can be detrimental to an organization's results. Management actions are responsible for identifying a problem and obtaining a division of work that will return an organization to its "harmonic state," the state of "soundness and good working order of the body corporate" (Fayol, 1964, p. 29). In short, in light of "different changing circumstances, for men just as different and changing and for many other variable elements" (Fayol, 1964, p. 29), management actions, as a stabilizing mechanism necessary for equilibrium, seek to establish the appropriate proportion of the division of work that produces the best results, as in "management affairs," he asserted, "it is all a question of proportion." This, Fayol wrote in the same place, is a "difficult art requiring intelligence, experience, decision and proportion" (Fayol, 1931, p. 25, 1964, p. 29). As circumstances change, so too does the appropriate proportion continually change, for "[c]ompounded of tact and experience, *proportion* is one of the foremost attributes of the manager" (Fayol, 1931, p. 26, 1964, p. 29, emphasis ours). This same position is repeated later in other texts (Fayol, 1921, p. 416, 1927c), and there is no evidence of experimental comparisons of the effects of a certain division of work in different companies, the details of any such experiments, modes of control, etc.

In this vein, the "sense of proportion" that we indicated above as an important factor in Fayolist writing (compared to Cartesian doubt in the case of Bernard) is striking. This sense of proportion, however, is not present in Fayol with any kind of systematic or focused attention because among the principles he listed, there are those of a relative nature, to which proportion corresponds, such as the division of work above, and those that are absolute, such as the unity of command, contradicting his own initial argument that all principles would be flexible and that nothing is "rigid or absolute in management affairs" (Fayol, 1964, p. 29). It is interesting to highlight the sense of proportion because it helps to emphasize practical experience, with a certain sense of art, in the author's understanding. This element seems to be as long established in Fayolism as the general inspiration from physiology that was in vogue at the end of the nineteenth century. It is no surprise that in his speech in 1900, Fayol harshly criticized the education of engineers, in particular due to the excess of mathematics. He even asked directly: "It is necessary to study mathematics, we agree; but to what extent?" (Fayol, 1964, p. 154). He himself responded: "On this question of proportion, I am of the opinion that the industry should have a leading voice" (Fayol, 1964, p. 155), that is to say, the practical needs of production should determine the proportion of mathematics education in schools.

In his 1916 book, the question of proportion appears at numerous moments, as "proportion," "spirit of proportion," "question of proportion," and "sense of proportion." Its place is not unimportant. Returning to the previous universal principle, Fayol wrote that the "division of work has its limits which experience, and a sense of proportion teach us may not be exceeded" (Fayol, 1964, p. 31). This same position, as we have suggested, reappears in the principles that are relative in nature. However, it is also evident at the end of the discussion of the principles as a whole, reinforcing their overarching importance. At the end of the chapter devoted to the topic, we read:

> Without principles, one is in darkness and chaos; interest, experience and proportion are still very handicapped, even with the best principles. The principle is the lighthouse fixing the bearings, but it can only serve those who already know the way into port (Fayol, 1931, p. 56, 1964, p. 58).

We are in the presence of a practical consciousness in which the "sense of proportion" can be easily identified with "common sense." As one of his main collaborators asked, when extolling the passage that would evidence the aforementioned adherence to the experimental method, wouldn't Fayol's methodological proposition be "the foundation of positive faith, the philosophical expression of this essential form of common sense which is the *sense of reality*?" (Vanuxem, 1927, p. 135, also see Verney, 1925, p. 42). Fayol himself voiced this identification of common sense, when he suggested that his management doctrine was not new, constituting a "set of ideas that are in everyone's mind, but which are still applied by a small number of people" (Fayol, 1927c, p. 19). It is common sense, not a rigorous experimental method in the terms seen above.

The "sense of proportion" (and its variants) is an ancient element among the Greeks, as with Hippocrates and the proportion between food and physical exercise. A similar position is found in Pseudo-Xenophon (2012), for whom proportion appears as a political expression in praise of Solon, as a subject from the "middle class" and, therefore, as a middle ground between the conflicting interests of landowners and Greeks who were debt slaves. It is also curious that Aristotle (1984) came up with the mean (middle ground) in the context of a discussion about ethics dedicated to his father, a physician by profession. This element likely dates back to time immemorial from the labor of hominids in the primitive effort to produce certain effects and, later, when transforming materials into other necessary objects, in which there is an appropriate proportion of strength, appropriate proportion of combined materials, etc. in light of expected results (Paço-Cunha, 2018); it is also present today in a series of practical everyday problems, such as the measure of ingredients in the preparation of meals or, more distantly, in the proper proportion of chemicals in laboratories. There are also numerous connections to the field of medicine, such as the right dosage of medications. There are also indications that this element of proportion was widely present in everyday French life in the transition between the nineteenth and twentieth centuries. On this, Bergson (2012) is symptomatic when he expresses the existence of a "spirit of precision" that echoed the alliance between French philosophy and the positive science of the period. The curvature that the medico-social ideology produced earlier in Comtian thought, and presumably in the later French environment, is no coincidence (Carrion, 1977).

Fayol was immersed in this context, particularly in the positivist vein. The crucial role of the sense of proportion shapes the understanding of Bernard's experiment in Fayolist writing: it is the limit of practical experience, which is fueled by the practical sense while simultaneously correcting it. The elements suggest that Fayol, in 1918, found in Bernard a belated potential mirror for a closer relationship between management and medical practice, given that the French physiologist was eager to turn medicine into science, seeking to "conserve health and cure diseases" (Bernard, 1949, p. 1) and the mining engineer, in turn, sought to establish "first the facts, [...] then the causes and, if possible, the remedies" (Fayol, 1927c, p. 33).

Nevertheless, even though Fayol found that possibility for a closer relationship, there is an enormous difference between their propositions, and not only in terms of the immediate objects. Bernard was clear that despite the differences between and even the different roles of the researcher and the practitioner, empirical and experimental medicine are inseparable. He did not fail to note, however, that the experimental method goes beyond the empirical moment, although it remains dependent on it:

> Empirical physicians are satisfied when, with the help of empiricism, they succeed in knowing that a given remedy cures a given disease, in learning the exact doses in which to administer it, and the cases in which it must be used, they may also believe they have reached the limits of medical science [...] [However,] it is not enough for experimenting physicians to know that quinine cures fever, but what is above all significant to them is knowing what fever is and accounting for the mechanism by which quinine cures (Bernard, 1949, pp. 208-209).

Fayol stopped short of indicating that a certain proportion in the division of work is healthy for the body corporate; he did not ask himself *what* the division of work *is* or its attendant problems; he did not attempt to scrutinize its historical nature, its role in a given economic context *vis-à-vis* the political; he did not pursue questions and procedures that would take him beyond the practical needs of his everyday experiences. He did not properly ask scientific questions that went beyond the immediate moment governed by practical economic needs. He was satisfied with attributing the division of work to nature, submitting the principle to the art of the proper proportion in order to cure the "disease," reestablishing the equilibrium of the body

corporate. At the limit, he did not go beyond the empirical moment. It was a teleological practical experience, physiologically informed, oriented toward social equilibrium and harmonization under the aegis of capitulation to economic needs.

These points underscore that the scientific demands of the experimental method are diluted by personal experience in the laboratory of everyday administrative life. The significance and the central place of the sense of proportion in the general Fayolist proposition are very symptomatic for this general conclusion.

FINAL CONSIDERATIONS

The objective of the present article was to analyze Fayol's relationship with Claude Bernard's experimental method. To this end, we adopted a historical approach to management science in the figure of the renowned French manager and theoretician.

In conclusion, we have seen that Bernard's experimental method made scientific demands that Fayol could not satisfy, and this helps to explain why, in Fayol, experiment and personal experience are intertwined but with an absolute absence of the former as far as "social phenomena" are concerned. In short, rather than the experimental method as such, we have the personal practical experience gained in the companies he ran, everyday observation, deduction and inference. This suggests a belated study of Bernard's text, after 1916, carried out by a disciple who was not very devoted to his master. It is not possible to rule out the possibility that the belated adherence to the experimental method was a declaratory alternative, in light of the founding of the Center for Administrative Studies in 1917 and its ambitions to disseminate Fayolism to broad sectors of French society at the time.

Our knowledge about the epistemological itinerary of notable figures in the field of management is broadened through the historical study of this knowledge process. It contributes, among other things, to filling certain gaps, such as the broad assertion that Fayolism was constituted on very empirical foundations. The correction of this statement must not obstruct our knowledge about the process, that is, about what would have actually occurred, such that the alleged adherence to the scientifically oriented experimental method cannot be confirmed in any detail.

As such, the history of management science is a promising field for academic-scientific studies. Not only Fayol, but many other authors or groups of authors can be taken as objects of historical investigations about the knowledge process in general, broadening our understanding of the contributions that helped shape studies and practice in management and organizations.

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