

## THE CONTROL OF NATURE AND THE ORIGINS OF THE DICHOTOMY BETWEEN FACT AND VALUE

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**Keywords:** Fact/value dichotomy, Control of nature, Modern science, Francis Bacon, Galileo Galilei, René Descartes, Blaise Pascal, David Hume

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### Summary

The objective of this chapter is to reflect on a distinction that is fundamental to the origin of a central aspect of current scientific practices. These practices, those which we are accustomed to call the practices of *modern science*, represent the development, and (as foreseen by Bacon in the *New Atlantis*) the complexification and specialization of a practice, a particular way of dealing with questions about nature, which arose and was consolidated in the 16th and 17th centuries. The articulation of this practice depended on the distinction between fact and value, which emerged in the first half of the 17th century in the works of Francis Bacon, Galileo Galilei, René Descartes and Blaise Pascal. I will show that the distinction between fact and value underlies the modern conception of the domination (control) of nature, a conception that, following subsequent developments, has ended up being taken to be a central value that orients scientific knowledge and technical/technological development.

### 1. Introduction

The dichotomy between fact and value arose in the course of the historical changes that led to the birth of modern science, that is, during the period – from the point of view of science – from Copernicus to Newton and – of philosophy – from Bacon to Hume. It was indispensable for determining what the proper domain of natural science should be. At the same time, it or the related dichotomies, between “is” and “ought” and (especially nowadays) between objective and subjective, accompanied the rise of epistemological individualism and the gradual abandonment of the principle of

authority, whether the authority be that of tridentine orthodoxy or of Aristotelian natural philosophy.

Subsequently, with the consolidation of science and the success of Western civilization in its quest to dominate nature (in the domain of facts) and with the crisis of authority (in the domain of values), it has become the dominant tendency in the contemporary world to interpret values as having a totally subjective foundation. Values then become understood as expressions of taste, of preferences, ultimately founded in what David Hume calls sensory impressions (emotions, sentiments) in order to refer to “our stronger perceptions, such as our sensations, affections and sentiments” (*Thu*, Book III, Advertisement; Hume, 1968, p. 453). This characterization of the sphere of values, as essentially linked with the emotions and sentiments, was again dominant in the 1930s in the thought of the logical positivists, for whom ethical (good or evil) and aesthetic assertions (beautiful and ugly) do not have *cognitive significance*, since they do not properly express knowledge; they only have *emotive significance*, being expressions of emotions and sentiments caused in individuals by events they happen to confront (cf. Stevenson, 1959; Putnam, 2002). Then, questions about values are subjective questions that can be considered questions merely about individual preferences. As we will see below, this ‘disqualification’ of the sphere of value is part of the scientific strategy of affirming the universality of instrumental reason, with the objective of covering up the evaluative character of the fundamental idea that orients technoscience: the control (domination) of nature.

The exposition that follows is organized around five distinct, historically important ideas that serve to fill out the meaning of (and role played by) the dichotomy between fact and value, each of which will be introduced by reference to the classical context in which it arose. In this way, analyzing the ideas comparatively and contextually, we will be able to grasp how the dichotomy between fact and value functioned historically.

## **2. First Idea: Sufficiency and Impartiality of the Natural Method**

The first idea deals with what, we might say, defines the fundamental difference between fact and value, guaranteeing that the sphere of facts has autonomy in relation to the sphere of values. A fact can be determined as *true* or *false* by means of a *encompassing autonomous method*, a method that is grounded fundamentally in that which is given to human beings by nature itself (or which is intrinsic to their own human nature) and that constitutes their *natural reason*, that is to say, *the senses, the intellect and language (the linguistic capacity to communicate)*. On the other hand, value depends on religious or civil *authority*, which makes judgments concerning the religious, moral, legal, etc. value of actions in contexts (situations) dependent of the interpretation and testimony of authorities. For example, according to the Catholic counter-reformation conception promoted by the Council of Trent (16th century), interpretation of the sacred scriptures must be in accord with the authority of the Fathers of the Church and the scholastic theologians. In virtue of its recourse to authority and tradition, the domain of values is profoundly rooted in the faculty of *memory*. The system for the transmission of knowledge, created by the Church beginning in the 12th century with the foundation of universities throughout Europe, is also grounded in memory, and obviously in the development of habits and capacities. In the university

curricula of the 16th and 17th centuries, the principle of authority has a central role and this helps to understand the difficulties faced by Galilean-type modern science for entering into the system of transmission of knowledge sponsored by the Church (cf. Mariconda, 2000, p. 85-90; p. 101-9.).

This idea, that we can arrive at truth or falsity about certain natural happenings by means of an *encompassing autonomous method*, is found clearly stated, for example, in Francis Bacon, both in his repeated attacks on theology that aim to undermine its venerable authority, and especially in the theory of idols developed in Book 1 of his *Novum Organum* (Bacon, 1960). Bacon's *idols* may be seen as being among the (epistemic and social) factors that shape the gaining of knowledge; and, for him, circumscribing them in order to eliminate their distorting effects involves putting the spheres of values outside of the scope of science. The idols are displayed at four levels: (1) The *idols of the tribe* derive from "human nature itself"; they are factors that universally shape the gaining of knowledge, involving weaknesses inherent in the very cognitive constitution of human beings, in the intellect and sensibility; and, since their distorting effects are impediments to the establishment of science, they must be bypassed. (2) The *idols of the cave* are social factors operating on the individual level, such as education and the habits acquired in social interactions, that cause distortions, and so they must be abandoned. (3) The *idols of the market-place* refer to the linguistic factors, necessary for stating knowledge, but which can cause distortions, and so that must be neutralized; and finally, (4) the *idols of the theatre* designate the theoretical (philosophical and theological) sources of distortion that must be eliminated. Throughout this process of purging science from the idols, Bacon makes a deliberate assault on authority, as when he proposes:

let him correct by seasonable patience and due delay the *depraved and deep-rooted habits* of his mind; and when all this is done and he has begun to be his own master, let him (if he will) use his own judgment (Author's preface; Bacon, 1960, p. 37, my italic).

Clearly, Bacon's attack on tradition and authority proceeds by means of a criticism of *habitus* (of the Aristotelian *hexis*). It is very important at this point to understand the centrality that Aristotle accorded to the habits and dispositions in the process of acquisition and transmission of knowledge. Aristotle takes science (like a virtue) to belong to the genus of habits (Categories, 8, 8b28-35); in the case of science, an intellectual habit which plays a role in the passage from potentiality to actuality, from a thing to know to one known. In fact, a habit is a bodily disposition that endures, acquired by repetition and training. It involves conceiving of the intellect as pliable, being able to mold or adapt itself to the things that it comes to know. Education aims for this type of adaptation of the intellect, which serves as the basis of a pedagogical view that utilizes repetition as a means for activating the memory and producing the retention of knowledge. One clearly finds this pedagogical ideal, for example, in Euclid's *Elements*. So, Bacon's critique of the *habitus* is a general critical attitude towards the habits that are rooted in the very constitution of human nature and that are developed by education and generated by social interactions. Only after these habits have been curbed is the mind ready, according to Bacon, to dedicate itself to the task of gaining knowledge of the facts.

In Descartes we find an entirely different strategy, but one which continues to affirm the separation of fact and value and, again, to consider the sphere of value in a negative light. Although, as is well known, he refrained from involvement in debates and controversies with theological and ecclesiastical authorities – and this distinguishes his stance from that of Galileo – Descartes, in making his criticism of memory and *habitus* (Descartes, 1955, *Rules for the Direction of the Mind*, p. 2; AT, 10, p. 359), severely attacked the very foundations of according positive value to their declarations. His refusal to concede any cognitive relevance to the “hermeneutic foundation” of values (that is, to basing them on the commentaries and interpretations of authoritative authors) reaches, thus, to the very core of the traditional system for transmitting knowledge maintained by the Church in the universities, which is based fundamentally on authority and memory. Being a strong expression of methodological individualism, his criticism of memory is also a negation of history and annihilation of tradition, for example, in Rule III, which explicitly excludes, as of no importance, “what others think”, and in which he says clearly that “though we have mastered all the arguments of Plato and Aristotle, if yet we have not the capacity for passing a solid judgment on these matters, shall we become Philosophers; we should have acquired the knowledge not of a science, but of history” (Descartes, 1955, p. 6; AT, 10, p. 367).

The provisional character of moral thought, as presented by Descartes in the Third Part of *The Discourse on Method* (Descartes, 1955, p. 95-100; AT, 6, p. 22-31), may be seen to reflect his acceptance of the existence of the dichotomy between fact and value and, also, to be a clear expression of the way in which modernity, by affirming the autonomy of the sphere of facts that derives from the character of the natural sciences, has relegated the sphere of values to a secondary status. It is worth adding that a consequence of Descartes’ provisional moral thought, located as it is within an individualist framework, is a tolerance based on indifference, and this tends irresistibly to become the dominant outlook.

Finally, since the method is based on natural reason, not only is it rational and, therefore, well able to serve as a propaedeutic to knowledge, but it is also impartial: it enables us to arrive at judgments independently of the values (prejudices, predilections, tastes, interpretive biases) that may be held by those who make scientific judgments. Thus, the method of modern natural science demonstrates its effective capacity for obtaining impartial and objective knowledge about the world; using it, we obtain objective knowledge of facts, knowledge of the order, interactions and structures underlying natural events (Mariconda and Lacey, 2001).

### **3. Second Idea: The Distinction between Natural and Moral Disciplines**

The dichotomy between fact and value is further elaborated in the context of a second idea, namely that the dichotomy corresponds to a new classification and organization of the scientific disciplines, which led to a complete restructuring of the traditional university curriculum. This new classification separates the *natural disciplines* from the *moral disciplines*. The former have to do with establishing facts, the latter proceed by evaluation, depend on interpretation and are established in the light of values.

There is disagreement between Bacon, on the one hand, and Galileo, Descartes and

Pascal, on the other, concerning the strictly empirical or mathematical character of investigation in the natural disciplines. Nevertheless, it is important to emphasize that in early modernity the view, that the natural sciences are those that apply *mathematics to the knowledge of nature* (astronomy, mechanics, acoustics (music), optics, hydrostatics, etc), clearly predominated. Since the scientific method is sufficient, these disciplines gain autonomy in relation to the moral disciplines (theology, politics and history), which are regulated by the principles of religious and civil authority. Although religious and civil authorities were not yet separated in the 16th and 17th centuries, we do find in early modernity the beginnings of the gradual process of separating them, and this process eventuated in the formation of the secular national State. Subsequent developments in later modernity have led to the crisis of authority in the political and social sphere, and this permitted other conceptions of values to come to the fore, for example, those of pragmatism (reducing values to utility), of subjectivism (reducing values to psychological states), and of individual rights (reducing values to rights).

Two authors of early modernity, Galileo and Pascal, provide the classic sources of the idea of the separation of the natural and the moral disciplines: the natural (scientific) disciplines, which aim for knowledge of nature; and the moral disciplines, whose aim (in accordance with their acceptance of the constraints of Christian orthodoxy) they considered to be salvation. The principal sources are Galileo's correspondence relating to the theological-cosmological polemics of 1613-1616, a set of important letters that Galileo wrote about the issue of the liberty of scientific research in opposition to the principle of authority; to Benedetto Castelli on December 21, 1613; to Piero Dino (February 16 and March 23, 1615); and to the Grand Duchess of Tuscany, Christina de Lorena (1615), and Pascal's Preface to *Treatise on the Vacuum* and the 18th *Provincial Letter*. Galileo clearly assumed the dichotomy between fact and value in making his plea for the autonomy of the mathematical science of nature, for example, in his letter of 1613 to Benedetto Castelli, in which the plea is based on the claim that the natural sciences use a method based on experience and mathematics, which is sufficient to decide questions about nature independently of theological authority. Moreover, since, for Galileo, the method is based on natural reason (senses, intellect and language), the unique characteristic possessed by all human beings, scientific knowledge has universal validity, and should be taken into account by theology in elaborating its interpretations of biblical passages that refer to natural events (Galilei, 1932 [1613], p. 282). The dichotomy, therefore, underlies the defense that Galileo explicitly makes for the autonomy of science in relation to the sphere of theological and philosophical authority (which held the hierarchy of values dominant in baroque and counter-reformation culture) and, in particular, for the clear affirmation of the universality of reason when dealing with the confirmation of natural facts. It also underlies the consequent thesis that scientific knowledge is superior to knowledge expressed in the moral disciplines.

Pascal, like Galileo, recognized that there are two sets of autonomous disciplines, the moral and natural disciplines.

In order to make this important distinction carefully, it is necessary to appreciate that the former [the moral disciplines] depend solely on *memory* and are purely historical, only having as their object of knowing what authors have written; the latter depend solely on *reasoning*, and are completely dogmatic, having as their object that of

searching for and finding hidden truths (Pascal, 1989, p. 62; my italics).

Pascal put history, geography, jurisprudence, languages and theology among the disciplines that aim only to know what the authors wrote, recognizing that in these disciplines “[i]t is authority alone that can enlighten us (...). But it is in theology where this authority has the most strength, because there it is inseparable from the truth (...) because its principles are above both nature and reason” (Pascal, 1989, pp. 62-63). On the other hand, on those matters that “ (...) fall under the senses or under reasoning; authority is useless here; reason alone is able to know them’, and these matters include “ geometry, arithmetic, music, physics, medicine, and architecture” (Pascal, 1989, p. 63). Galileo and Pascal also agree that the method of science involves a special combination of the senses and reason, a mixture of experience and mathematics, in which the facts of experience have a very special role in the autonomous functioning of the method, autonomous in relation to the authority of theology (see Galilei, 2003 [1640]; Mariconda, 2003).

Nevertheless, Pascal, unlike Galileo (who proposed the universality of scientific judgment, which he held ought to be considered superior to the most authoritative and orthodox of the exegetical interpretations of the Bible), recognized something positive in the autonomy of the distinct disciplines. That is because, for him, values are not to be considered secondary; and the claims of science ought always to be open to question. For Pascal, reason promises more than it can deliver. Already in Pascal we find a clear movement towards the critique of reason and recognizing its limits (Guenancia, 2005, p. 24-6). This leads to a striking difference of perspective between the positions of Galileo and Pascal concerning the nature of scientific knowledge. For Galileo, as for Descartes, science has an apodictic character; the natural sciences are *necessary and demonstrative*; they can lead to *certainty*, to necessary truths. Furthermore, the sciences are based on the universality of natural reason, so that scientific results are guaranteed by the existence of a rational procedure (method), to which all who possess natural reason have access. In Descartes, we can find such a conception clearly exposed, for example, in Rule 1 of Rules for the Direction of the Mind, where the unity of science is guaranteed by the unity of natural reason (Descartes, 1955, p.1; AT, 10, p. 360; Descartes, 1985, p. 12), and in Rule IV, where the priority of method (as a set of ‘certain and easy rules’ about the object of investigation or investigation itself (Descartes, 1955, p. 9; AT, 10, p. 372; Descartes, 1985, p. 24). The same theme already appears, but in a much more opaque way, in Galileo’s letter to Castelli (Galilei, 1932[1613], p. 284). For Pascal, in contrast, what is shared universally is the miserable finitude of individual natural reason and the fallibility of human knowledge, and these ensure that the natural sciences, which are dependent of the cooperation of individuals, will always be open to further improvement. It is because natural reason can only be manifested in each individual that science is an endeavor that can only be carried out with the cooperation of human beings. Thus, science is a collective endeavor through which natural reason is universalized, in such a way that scientific understanding is *hypothetical* – knowledge arrived at through the senses and by reason can only aspire to possibility and probability – and *open to improvement* – always in the process of being improved (Pascal, 1989, p. 63). However, Pascal recognizes fully the autonomy of the sphere of values, in a way that leads him to deny that the thesis of the universality of human reason holds in it. Rather, he considers that together, the dependence of the

historical and human disciplines on the principle of authority and the necessity of interpretation of original texts, enable these disciplines to arrive at understanding that approximates certainty. For Galileo and Descartes, on the contrary, because they depend on the play of interpretations and possess an exegetical (historical) character, these disciplines engender hypothetical and very uncertain understanding.

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### **Biographical Sketch**

**Pablo R. Mariconda** has obtained his Master degree and the Ph.D. in Philosophy by the Universidade de São Paulo, Brazil, the latter in 1986. From then on, he has dedicated himself to the development of the doctoral program of philosophical studies on science and technology. During 1998-2000, he was awarded with a post-doctoral and has pursued advanced research at Equipe Rehseis of CNRS – France – a team devoted to the history of science and of the scientific institutions. He has translated into Portuguese the more important works of Galileo, the *Dialogue* (1632) and the *Discourse* (1638), with historical and contextualized introductions and critical notes. From 2002 to 2005, he was head of the Department of Philosophy at Universidade de São Paulo. In 2005, he became Professor of Theory of Knowledge and Philosophy of Science at the same university. Since 2003, he is the editor of *Scientiae Studia*, a quarterly Latin-American journal, published in Portuguese and Spanish, devoted to the Philosophy, History and Sociology of science. Actually, he is director of a Thematic Research Project, which investigates the origins and significance of Technoscience, with special concern on the relations between science, technology and society; connected with this, he also directs a Collection of Studies on Science and Technology, which is designed to publish the results of the thematic researches. Member of the Consultative Council of the Parc of Science and Technology (CienTec) of Universidade de São Paulo, where he directs a special program for applying philosophy and history of science to scientific education at high school level.