
“A New Logic”: Bacon’s *Novum Organum*

Elodie Cassan

ENS Lyon

The purpose of this paper is to assess Bacon’s proclamation of the novelty of his Novum Organum. We argue that in the Novum Organum, Bacon reshapes the traditional representation of logic as providing tools for the building of philosophical discourse. For he refuses both an understanding of logic in terms of an ars disserendi, and an approach to philosophy in terms of a discourse of a certain type of necessity and universality. How can Bacon articulate a logic, that is, a set of rules with formal features, on the basis of a distrust of the paradigm of discourse? This seemingly paradoxical definition of logic follows from Bacon’s rejection of the conception of the scientific reasoning provided by the Organon. It also stems from his reworking of Aristotle’s semiotics, in an effort to deal with the gap between what reality consists in and what the mind perceives of it.

Francis Bacon calls his *Novum Organum* “a new logic.”¹ The purpose of this paper is to elucidate this phrase, which has received very little scholarly attention so far, as the *Novum Organum* has often been quoted without being properly read. First, this book has commonly been reduced to its title. It has metonymically been interpreted as basically promoting philosophical modernity, as, for instance, Descartes’ *Discourse*

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1. As he puts it in a 1620 Letter to King James I when presenting him with the *Novum Organum*: “The work, in what colours soever it may be set forth, is no more but a new logic, teaching to invent and judge by induction, (as finding syllogism incompetent for sciences of nature) and thereby to make philosophy and sciences both more true and more active” (Bacon 1874, pp. 119–20).

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on *Method*. This use of the *Novum Organum* as a sort of catchword has contributed to the construction of an image of Early Modern Philosophy as grounded on the Scientific Revolution and as justifying man's mastery of nature.² We claim here that the traditional consideration of these legacy issues has to be accompanied by a research into Bacon's specific agenda lying behind his writing of the *Novum Organum*. Second, this book has been assessed in terms of the part it plays within the framework of Bacon's philosophical project, the *Instauratio Magna*. Debates about the role of provider of a method for Bacon's natural history played by the *Novum Organum*, paved the way for contextual investigation of the origin and the development of his new approach to this discipline.³ But these contextual assessments of Bacon's project lead to a shift of the focus away from the *Novum Organum*. So in the end, the *Novum Organum* may be a tenet of traditional historiographical narratives about the building of modern philosophy, or an element of a wide in scope philosophical project, sidelined by scholars. Nevertheless, its exact purpose and its specific structure have been overlooked. Our aim in this paper is to contribute to bringing that situation to an end. We shall do so by accounting for the academic discipline category Bacon resorts to in order to qualify the field the *Novum Organum* belongs to: logic.

To begin with, the famous title Bacon gives to his book refers to logic, as a discipline taught as a propaedeutic to philosophy in the academic field. As it is well-known, in the Renaissance the term "organum," which indicates the instrumentality of logic, is also commonly used in order to describe Aristotle's logical writings: the *Categories*, *On Interpretation*, the *Prior Analytics*, the *Posterior Analytics*, the *Topics*, *On Sophistical Refutations*. Besides, Bacon's connecting of the term "organum" to the adjective "novum" reveals that, in the *Novum Organum*, he intends to depart from Aristotle's *Organon*, that is, to contribute to a renewal to logic as a discipline, beyond the university. As a matter of fact, Bacon treats the category of logic as a breadcrumb trail helping one make his way through his book, taken as a whole. Not only does he call, in the *Distributio Operis*, the final preliminary before the *Novum Organum* itself, the "doctrine of improving and perfecting the use of reason in the investigation of things" he is about to expound, "a kind of logic."⁴ In the last aphorism of the second part of the *Novum Organum*, he also encapsulates the goal pursued in this text with, again, a reference to logic. As he puts it, the end of his logic "is to teach and instruct the intellect not to batten on and embrace abstract things with the mind's fragile tendrils (as

2. See for instance Lalande 1911; Rees 2002, Pérez-Ramos 1991; Giglioli 2013a.

3. See in particular Rees 1981; Garber 2014; Corneanu et al. 2012.

4. "Destinatur itaque Parti Secundae: Doctrina de meliore et perfectiore usu Rationis in rerum inquisitione [...]. Est ea, quam adducimus, Ars (quam *Interpretationem Naturae* appellare consuevimus) ex genere Logicae" (Bacon 2004, p. 28).

common logic does), but really to slice into nature.”⁵ In other words, Bacon constructs the category of logic in terms of a preliminary set of rules applied to natural philosophy. He designs logic in order to make the mind access things “as they are.” Our purpose in this paper is to consider the main features of this approach to logic, as it is elaborated in the *Novum Organum* and illustrated by it.

As we shall show, upon articulating rules for the building of scientific reasoning in connection with assumptions about the way the world is, Bacon addresses a semiotic issue: that of the nature of the relationship between reality, thought and language. This issue is crucial to the shaping of logic in the early modern period. As it is well known, Aristotle’s claim, in the treatise *On Interpretation*, that concepts signified by words signify things, supports the theory of reasoning articulated in the *Organon*. As a consequence, an *Organum* designed as *Novum* has to challenge Aristotle’s semiotics. The problem, then, is the following.

On the one hand, in the *Advancement of Learning* (1605), as well as in the *De augmentis scientiarum* (1623), Bacon explicitly endorses Aristotle’s statement in the *On Interpretation*, 1.1. As he puts it, “Aristotle sayth well: *Wordes are the Images of Cogitations, and Letters are the Images of Wordes.*”⁶ In this passage, Bacon does not endorse the threefold semantic theory. However, he does endorse an aspect of Aristotle’s semantic theory from the same book in which he argues for that threefold relationship. So, from the point of view of pure semiotics, Bacon may be an Aristotelian. But, on the other hand, while researching the experimental procedure permitting a methodical and systematic exploration of natural phenomena, he thinks that there is an irreducible gap between what reality consists in and what the mind perceives of it. Put differently, he addresses experience on the grounds of a non-Aristotelian ontology, of a non-Aristotelian theory of mind and of a non-Aristotelian theory of knowledge. In this paper, we emphasize the part played by the coordination of these elements, that is, by Bacon’s discussion of Aristotle’s semiotics, in the shaping of his *Novum Organum*.

In so doing, we intend to shed light on the unity of this book. We contend that the way Bacon builds his theory of reasoning throughout the book shows that the *Novum Organum* has a conceptual unity, even if it is a deliberately unfinished and unsystematic book, divided into two books, respectively comprising 130 and 52 aphorisms. On the one hand,

5. “cum Logica nostra, doceat Intellectum et erudiat ad hoc, ut non tenuibus Mentis quasi Claviculis rerum Abstracta captet et prenet (ut Logica vulgaris) sed Naturam revera persect et Corporum virtutes et Actus, eorumque leges in Materia determinatas inveniat” (Bacon 2004, p. 442).

6. Bacon 2000, p. 119. “Rectè enim Aristoteles; *Cogitationum Tesserae verba, Verborum literæ*” (Bacon 1874, vol. 2, book 6, chap. 1, p. 410).

the *Novum Organum's* influence over early modern philosophy and early modern logic, as a book of logic, has been acknowledged from the seventeenth century on. Stated bluntly, in this context readers of the *Novum Organum* have shown an interest in its first book's doctrine of the idols and in its second book's theory of induction, either alternatively or altogether. Expressions of interest took three main forms: literal comments about the content of the *Novum Organum*, integrations of passages taken from it into books of logic, assessments of some of this text's key concepts so as to serve non Baconian logical or philosophical agendas.⁷ On the other hand, within the framework of the complex reception of the *Novum Organum*, which still needs to be further investigated, the question of what makes the unity of this book as a whole, has always been bracketed away. Such is the issue at stake here.

In Bacon's view, reason, the seat of philosophy, is a fragile faculty to which logic provides support and assistance against the risk of error and falsity. As we will see, within this apparently standard scenario of the introductory and ancillary function of logic with respect to philosophy, Bacon reshapes the traditional representation of logic as providing tools for the building of philosophical discourse. For he refuses both an understanding of logic in terms of an *ars disserendi*, and an approach to philosophy in terms of a discourse of a certain type of necessity and universality. In this paper, we intend to show how Bacon articulates a logic, that is, a set of rules with formal features, on the basis of a distrust of the paradigm of discourse. Our contention will be that this seemingly paradoxical definition of logic follows from Bacon's rejection of the conception of the scientific reasoning provided by the *Organon*, and from his reworking of Aristotle's approach to semiotics.

To begin with, we ground the new reading strategy of the *Novum Organum* drawn in this paper, on the claim that the project pursued by Bacon in this book gives it both a unity of intent and accounts for its general structure, that is, for its bipartition. As is well established, in the *Novum Organum*, Bacon intends to replace the syllogism, that is, the deductive form of reasoning which is the center of the *Organon*, with induction, that is, with the process of propositional inference designed by Aristotle in order to bring out the premises of the syllogism. So far, in the secondary literature Bacon's plan has been addressed in terms of a general switch from a conception of logic as an art of communication, based on the syllogism, to an approach to

7. Concerning the first case, see for instance Gassendi (1658, T I, pp. 62–5, 90). Concerning the second case, see for instance Clauberg (1658, pp. 29–34). Concerning the third case, see for instance Spinoza's 1661 Letter to Oldenburg (1924, pp. 8–9); Malebranche 1674 (1979, pp. 209–10).

logic as an instrument of scientific discovery, based on induction.⁸ It has to be underlined that this scholarly common interpretation has the merit to show the unity of intent the *Novum Organum* proceeds from, because, as such, it accounts for the general presentation of the *Novum Organum* provided by the *Distributio Operis*. In this important programmatic text, which emphasizes the conceptual unity of the series of aphorisms the *Novum Organum* is made of, Bacon argues that his focus on induction serves a general project of contributing to a global redefinition of the function, of the structure, and of the basis of logic. As he puts it, his project is to build a logic which differs from common logic (*logica vulgaris*) “in three ways especially: in its end, order of demonstration, and the inquiry’s starting points” (*differt autem plane a Vulgari, rebus praecipue tribus: viz. ipso fine, ordine demonstrandi, et inquirendi initiis*) (2004, p. 28). Accordingly, he claims that he rejects syllogistic demonstration which

works haphazardly and lets nature slip through its fingers. For though no one doubts that things agreeing in a middle term agree with each other (which is a kind of mathematical certainty), yet this conceals sleight of hand, for the syllogism is made up of propositions, propositions of words, and words are the tokens and signs of notions. Thus, if the very notions of the mind (which are the soul of the words and the basis of this whole fabric and structure) are ineptly and recklessly abstracted from things, and vague, and insufficiently delimited and circumscribed, and indeed rotten in many ways, everything collapses.⁹ (Bacon 2004, p. 31)

In other words, in Bacon’s view, the grounding of syllogism on ill-determined first principles leads to the forming of middle propositions whose validity is not guaranteed. So, the conclusion obtained by a syllogism cannot reach nature. It only attains to words.¹⁰ For Bacon, as the syllogism is constituted by verbosity and uncertainty, it provides a method for disputation, not for science. Therefore, the syllogism should be replaced with induction because that very form of reasoning has been conceived from Aristotle onward so as to bring the first principles out.

8. Howell 1961; Jardine 1974.

9. “At nos demonstrationem per Syllogismum rejicimus, quod confusius agat, et Naturam emittat e minibus. Tametsi enim nemini dubium esse possit, quin, quae in medio termino conveniunt, ea et inter se convenient, (quod est Mathematicae cujusdam certitudinis), nihilominus hoc subest fraudis, quod Syllogismus ex propositionibus constet, propositiones ex verbis, verba autem notionum tesserae et signa sint. Itaque si Notiones ipsae mentis (quae verborum quasi anima sunt, et totius hujusmodi structurae ac fabricae basis) male ac temere a rebus abstractae, et vagae, nec satis definitae et circumscriptae, denique multis modis vitiosae fuerint, omnia ruunt” (Bacon 2004, p. 30).

10. Charrak 2005, p. 471.

It is true that the concept of induction, far from being a Baconian invention, belongs to a traditional logical lexicon. But Bacon understands the notion of induction very differently than Aristotle does in the *Posterior Analytics* and this difference is highly significant. In a way, he reinvents the concept of induction, because his reworking of the Aristotelian approach to induction amounts to attributing induction a new place and a new part within the system of knowledge. First, he does not list the inductive process among the preliminaries of scientific reasoning. As he articulates it, induction is rather in itself the adequate "form of demonstration" (*demonstrandi forma*) (Bacon 2004, pp. 30–31) in the field of knowledge under consideration in the *Novum Organum*, namely, natural philosophy. Second, in addition to putting induction in the foreground, Bacon entirely reshapes it. In this framework, he takes Aristotle's account of induction as grounded on simple enumeration, as it is accounted for by Early Modern dialecticians. According to Bacon, this approach to induction generates "a childish thing unsafe in its conclusions, vulnerable to a contradictory instance, caring only for the customary, and incapable of getting results" (*Ea enim de qua Dialectici loquuntur quae procedit per Enumerationem simplicem, puerile quiddam est, et precario concludit, et periculo ab instantia contradictoria exponitur, et consueta tantum intuetur; nec exitum reperit*) (2004, pp. 30–32). In Bacon's view, there is no point in structuring induction in terms of a flight "up immediately from the sense and particulars to the highest generalisations" (*res ita geri consuevit, ut a sensu et particularibus primo loco ad maxime generalia advoletur*) (2004, pp. 30–31), that is, in terms of a jump to conclusions: it amounts to using not enough induction. Bacon claims that such promotion of logical rapidity amounts to deliberately ignoring the complexity of experience. He takes this gesture to be problematic from an epistemological point of view: it impedes access to nature. He therefore believes that the Aristotelian inspired form of induction has to be replaced with the finding and placing in order of "a forest of particulars and materials in number, kind and reliability in a way sufficient for informing the intellect" (*Particularium sylva et materies, vel numero, vel genere, vel certitudine, informando intellectui competens*) (Bacon 2004, pp. 154–5). This is the kind of induction he champions in the *Novum Organum*: a logical form "which will unbind experience and separate it out, and reach necessary conclusions by proper exclusions and rejections" (*opus est ad Scientias Inductionis forma tali, quae experientiam solvat et separet et per exclusiones ac reiectiones debitas necessario concludat*) (2004, p. 33). So there is no question that the writing of this book fulfills a very precise and determined agenda: the promotion of a reinvented form of induction for scientific purposes.

But furthermore, it shall be added that this program also accounts for the dialectical unity the two books composing the *Novum Organum* rely on.

Strikingly, the structure of the *Novum Organum* matches the dialectics of “exclusions and rejections,” that has just been exposed. Scholarly attention hasn’t focused on this noteworthy phenomenon so far. For some readers, Bacon’s logic only begins in the second book of the *Novum Organum*, while for others it is fully exposed in the first book. These contradictory reading strategies stem from the frequent understanding of the bipartition of the *Novum Organum* in terms of the succession of two isolated entities, strictly separated and independent from one another. As is known, in the first book of the *Novum Organum*, Bacon identifies the causes of the errors made by the intellect if it is supported in its natural impulse by traditional logic. He emphasizes the many shapes taken by these errors, categorizing four kinds of idols. Then, in the second book, he delivers the rules of induction, whose use is the condition of what he calls the “interpretation of nature.”¹¹ He believes that it is necessary to finish to purify and purge the mind before setting forth “the true way to the interpretation of nature” (*veram interpretandae Naturae viam*) (Bacon 2004, pp. 110–11). In other words, he structures his work according to a *destruens/construens* dialectics. In the light of this dialectics, the conceptual continuity between the two books of the *Novum Organum* becomes visible.

Bacon makes this continuity visible when he argues in the first book that “the doctrine of idols stands in a similar relationship to the *Interpretation of Nature*, as the doctrine of Sophistical Refutations to ordinary dialectic” (*Doctrina enim de Idolis similiter se habet ad Interpretationem Naturae sicut doctrina de Sophisticis Elenchis ad Dialecticam vulgarem*) (2004, pp. 78–9). In this passage, he brings about the *Sophistical Refutations*, the last part of Aristotle’s *Organon*, as the logical starting-point of his logic. In other words, he shares Aristotle’s conviction that a recognition of misleading forms of reasoning, which imply a material confrontation with error, is instrumental in learning how to avoid making false conclusions. But unlike Aristotle, he takes the knowledge of the formal matrices generating invalid conclusions and deduction, to be the chapter to begin with, in the framework of the learning of logic. He does so because he is concerned with the issue of the nature of the reliable formal materials to put together and to assemble in order to make sound judgments. His gesture is informed by an intrinsically logical concern. To put it in a nutshell, Bacon learned logic and accessed a simplified treatment of Aristotle’s logic, within the framework of Humanist and Ramist logic.¹² In this cultural context, a reasoning is the assembling of previously

11. The cultural significance of the syntagm “interpretation of nature” is illuminated by Serjeantson 2014.

12. This is not to say that Bacon did not have a direct access at all to Aristotle’s texts. See Durel 1998, Anstey 2015.

formed arguments according to topics. Differently put, one has to invent prior to judging.¹³ Considered in the light of this context, Bacon's ordering of logic matters in the *Novum Organum* shows that he questions the qualification of the topics as the adequate framework for the invention of arguments. His insistence on the idols, in the first book of the *Novum Organum*, illustrates his conviction that the materials of invention must not be treated as a given, to be taken at face value, and that they have to be investigated. Such investigation is the purpose of the second book of the *Novum Organum*. There, Bacon indicates the steps to follow in order to conduct this research, and its expected outcome.¹⁴ So Bacon assesses the ingredients of a valid inference throughout the *Novum Organum*.

We suggest that Bacon's establishment of a strict continuity between the two books of the *Novum Organum*, both concerned with the articulation of the scientific inferential process, entitles him to claim that he is constructing a "new" logic. In making this case, we will take side against an old narrative which equates logic in the Early Modern period with syllogistic and which takes it that Bacon's criticism of syllogistic illustrates his lack of interest in logic "in that sense of the word which interests us."¹⁵ This traditional narrative aims at tracing the development of formal logic from its origin to the present day. According to it, while the *Novum Organum* constitutes "the first modern attempt to formulate a doctrine of scientific method," it tends to neglect formal logic in favor of "the new study of a heuristic methodology" whose conceptual basis has to do more with psychological issues related to the human cognition than with strictly logical matters.¹⁶ According to this interpretation, it is as if there was no difference in purpose between today's logic and Renaissance and Early Modern logic. We contend that this allegation is wrong—mere retrospective illusion. Stated clearly, albeit quickly, Renaissance and Early Modern logic goes further than reflecting upon principles of validity, as today's logic does. During that period, logical inquiry also addresses truth in its material

13. See respectively Jardine 1974 and Rossi 1974 on the influence of Humanist and Ramist logics on Bacon. Needless to say, these traditions are distinct from one another. But they have a common feature: a resort to the Ciceronian couple *inventio/judicium* in order to structure their logics. Cicero joins these concepts in his *Topics* when commenting on Aristotle's *Topics*: "cum omnis ratio diligens disserendi duas habeat artes, unam inveniendi, alteram iudicandi, utriusque princeps, ut mihi quidem videtur, Aristoteles fuit. Stoici autem in altera elaboraverunt. Iudicandi enim vias diligenter persecuti sunt, ea scientia quam dialecticam appellant. Inveniendi vero artem, quae topicam dicitur, quae et ad usum potior erat et ordine naturae certe prior, totam reliquerunt" (Cicero 2003, p. 118).

14. Gaukroger has the striking claim that the prerogative instances articulated in the second book of the *Novum Organum* "serve very much the function of the topics, as conceived by Aristotle in a general context, and by his Renaissance followers as rhetorical guides" (see Gaukroger 2001, p. 153).

15. Kneale 1962, p. 310.

16. Kneale 1962, pp. 309–310.

sense and the operations of the mind that are responsible for the building of a reasoning. In other words, during that period, logic, taken as a discipline, had formal, epistemological, and psychological components which must be considered as an inseparable unit, as more recent research has begun to show. We shall establish that a recombination of these features is at the core of Bacon's criticisms of the syllogism in the *Novum Organum*. We shall show that Bacon contributes to the conceptual formulation of the logic of his time, while criticizing the syllogism.

To begin with, Bacon accounts for the blame he puts on the syllogistic form of reasoning in psychological terms. In the *Novum Organum*, he identifies reasoning with "syllogising," following a tradition developed from Cicero to Ramus. He depicts the syllogism as a form of reasoning naturally proceeding from the act of reasoning of the intellect (Bacon 2004, pp. 160–61). He points out that what makes syllogisms problematic in his view, is that they are the natural outcome of a naturally distorted mind. So, Bacon's search for an appropriate form of reasoning is grounded on a systematic study of the way the mind naturally operates. Differently put, unlike what has frequently been written, in the beginning of the seventeenth century formal logic and psychology work together. The telling of this story is essential as it provides a new observation unit of Early Modern philosophy.¹⁷ As is well known, in the *Novum Organum* Bacon believes that men reason with a naturally distempered mind, operate with inadequate means of communication and rely on a corrupt philosophical culture. In this perspective, he traces the "idols," the erroneous notions formed by men on these groundings and the ill-ordered predispositions of the mind that account for them. These are well-established scholarly points.

They shall be complemented with an important element, namely, the indication of what is at stake in Bacon's consideration of the mind in the *Novum Organum*. We suggest that such consideration serves logical purposes. For Bacon, first, it is necessary to compensate for the supposedly natural inconsistency of the mind, by formalizing the operations of thinking; second, it is possible to set out procedures for appropriately reasoning. Hence, his methodological search for and design of rules to resort to so as to avoid making mistakes. In this framework, Bacon's insistence on the sterility of the syllogism reveals the depth of his interest in logic and the grounding of this interest on a non-sceptical position regarding the psychology of knowledge. His gesture shows that in the Early Modern period, the development of logic is commanded by the need to assist the mind in its efforts to know the world. But what it entails goes even further. If in the Early Modern period, logic is the tool of a mind at work, then its shape might depend on the type of object, on the

17. The introduction of this volume paves the way for the writing of this story.

particular science it actually works on. Such is, at least, Bacon's conviction. This is precisely the reason why he restrains the scope of the use of syllogism to certain fields of knowledge, "popular arts and matters of opinion," while centring the scientific inferential process around a reinvented induction, designed as natural philosophy's new *organon*.¹⁸ This is a paradoxical and perhaps a deliberately provocative restraint, given the centrality of syllogistic reasoning in contemporary natural philosophy. In any case, it shall be pointed out that Bacon's concern with setting out a legitimate form of reasoning about nature does not lead him to undermine the syllogism as such. In the end, Bacon's logic is "new," in so far as it redefines the nature and the uses of the logical tools owed to the past.

The issue at stake in Bacon's reshaping of logic is famous: the paving of the way for his natural philosophy, following the traditional view of logic as a propaedeutic to philosophy.¹⁹ Bacon advocates the epistemological reason accounting for the logical instrumentation he proceeds to, throughout the *Novum Organum*. For instance, in the *Distributio Operis*, he famously articulates the intended purpose of his logic in terms of the adorning and of the decking out of "the marriage bed of the mind and the universe" (*thalamu(s) mentis et Universi*) (2004 p. 36). We intend to make the case that the prospect of a wedding between the mind and the universe merely is a baroque formulation of the purpose of logic, in so far as this discipline is oriented towards material truth, and in so far as it provides a theory of reasoning whose shape is determined by specific assumptions about the relationship between things, concepts and words.

Our contention here is twofold. First, we shall show that upon constructing logic this way, Bacon grounds it on a concern with semiotics, as does Aristotle. As we know, in the treatise *On Interpretation*, the second book of the *Organon*, Aristotle puts forward the claim that the relation between reality, thinking, and language is that of the existence of a natural relationship between the order of things and the order of thought, so that concepts, signified by words, signify things.²⁰ The entire point of the

18. "Quamvis igitur relinquamus Syllogismo & hujusmodi Demonstrationibus famosis ac iactatis, iurisdictionem in Artes populares & opinabiles (nil enim in hac parte movemus) tamen ad Naturam Rerum, Inductione per omnia, & tam ad minores propositiones, quam ad maiores, utimur" (Bacon 2004, p. 30).

19. "Illud vero monendum, nos in hoc nostro *Organo* tractare Logicam, non Philosophiam" (Bacon 2004, p. 442).

20. This semantic remark has been formalized from Boethius on. See Boethius's commentary to Aristotle's *On Interpretation*: "Tria sunt ex quibus omnis colluctio disputatioque perficitur: res, intellectus, voces. Res sunt quas animi ratione percipimus, intellectuque discernimus. Intellectus vero quibus res ipsas addiscimus. Voces quibus id quod intellectus capimus, significamus. Praeter haec autem tria est aliud quiddam quod significat voces, hae sunt litterae, harum enim scriptio vocum significatio est. Cum igitur haec sint quatuor: res, intellectus, vox, littera; rem concipit intellectus, intellectum vero voces designant, ipsas voces litterae significant" (Boethius 1877, 1. 37).

theory is that concepts are intermediate between things and words, and that words do not directly connect to things.²¹ As such, this theory indicates the necessary condition for the meaning, reference and truth of propositions. So, it supports the theory of reasoning built by Aristotle in the *Organon*. We suggest that similarly, Bacon's views about semiotics shape the theory of reasoning he provides in the *Novum Organum*. Secondly, we shall show that Bacon's philosophical move in this book consists in using Aristotle against Aristotle in that respect. To be sure, the shape taken by the *Novum Organum*'s plan for the reformation of knowledge is basically determined by a methodical reworking of Aristotle's approach to semiotics. So in our view, Bacon is entitled to depict as a "new logic" the theory of experimentation he works on in the *Novum Organum*, because he grounds its articulation on a non-Aristotelian approach to meaning and signification.

So far, Bacon's treatment of the relationship between things, concepts, and words has not attracted much scholarly attention, as such. It is known that Bacon takes a stand against Aristotle's position because, in his view, it displays an ignorance of the way the mind actually works. As it has frequently been commented on and discussed, Bacon believes that "the human intellect is to the nature of things like an uneven mirror which mingles its own nature with the nature of things, and distorts and stains it."²² Differently put, it is established that according to Bacon, Aristotle's grounding of true knowledge of reality on the presupposition of an isomorphism between, on the one hand, sense perception and notions, and, on the other hand, the external world, is an error: as "all perceptions of sense and mind are built to the scale of man and not the universe" (*omnes perceptiones tam sensus quam mentis sunt ex analogia hominis, non ex analogia universi*) (Bacon 2004, p. 80), notions don't inhere by themselves in the very essence of things. The linguistic consequences entailed by this reasoning have even been underlined: words, which are generally imposed according to common capacity, generate no knowledge and "the great and solemn disputes of learned man, often end in controversies about words and names" (*fit ut magnae et solennes disputationes hominum doctorum saepe in controversias circa verba et nomina desinant*) (Bacon 2004, p. 92). But the way Bacon addresses the semantic relationship between things, concepts and words, has seldom been studied. We suggest that Bacon's understanding of this relationship accounts for his will to build his new logic on new semantic groundings. We claim that this renewal has a highly significant philosophical import,

21. The debate over whether words signified ideas or things is a long-standing one in Early Modern logic. It has been studied to good effect by Ashworth 1981.

22. "estque intellectus humanus instar speculi inaequalis ad radios rerum, qui suam naturam Naturae rerum immiscet, eamque distorquet et inficit" (Bacon 2004, p. 80).

as the semiotic triangle basically is the crossover point between logic and ontology.

In so doing, our plan is to shed new light on the formal features Bacon ascribes to logic throughout this book taken as a whole. It has been remarked that according to him, the pursuit of true knowledge requires a cure of the mind's natural impediments. Bacon's logic has been accurately depicted in terms of a "curative regimen for the mind," in so far as "the solution of the problem of knowledge takes the form of a solution to the problem of ordering the mind."²³ This therapeutic and psychological account now has to be completed from a formal and epistemological point of view in order to illuminate the whole project of the *Novum Organum*. Therefore, this account has to be correlated to an elucidation of Bacon's procedure for the adjusting of the order of thought to the order of things, as well as to a study of his approach to the materiality of reality. Our view is that we have to consider the way Bacon addresses the semantic relationship between things, concepts and words in the *Novum Organum*, in order to delineate the full scope of his logic.

We shall emphasize that Bacon's repeated claims that reasoning has to be close to "the things themselves," amount to grounding semantics on a non-Aristotelian ontology. Bacon's intention is made clear by his undermining of Aristotle's way of connecting logic and natural philosophy. This refutation illustrates his dismissal of an Aristotelian theory of meaning and reference. It takes place in the first book of the *Novum Organum*, within the framework of a classification of the idols into four kinds: idols of the tribe, idols of the cave, idols of the market place, idols of the theater. In this framework, Bacon first exemplifies with Aristotle his presentation of the idols of the cave, comprising the errors made because of the peculiar nature of the individual and of the habits he gets into. He depicts Aristotle as a man whose concern with general reflections fills his mind with fantasies, which distorts his approach to philosophy. Accordingly, he alleges that "Aristotle made his natural philosophy a mere slave to his logic, and so rendered it virtually useless and disputatious" (*Naturalem suam Philosophiam Logicae suae prorsus mancipavit, ut eam fere inutilem et contentiosam reddiderit*) (Bacon 2004, p. 88). Bacon refers to Aristotle a second time when he addresses the idols of the theatre, which basically consist in a list of the erroneous visions of the world produced by the philosophies from the past, because of their non-methodical way of thinking. In this case, Bacon goes further than presenting Aristotle as a man holding a poor way of thinking. The remarks he formulates involve an assessment of the Aristotelian philosophy

23. Corneanu 2011, respectively pp. 18, 5.

as a whole, as it provides “the most obvious example” of the first type of the idols of the theatre, namely, “sophistical philosophy”:

With his dialectic [Aristotle] corrupted natural philosophy when he fashioned the world from categories; doled out that most noble substance, the human soul, a genus of terms of the second intention; settled the business of dense and rare, whereby bodies take on greater and lesser dimensions or volumes, by the frigid distinction of act and potency; claimed that motion in particular bodies was singular and proper to them, and that if they shared in any other motion that circumstance came from an extrinsic cause; and forced on the nature of things countless other ideas as the whim took him. As he was everywhere more concerned about how someone replying to a debate might parry a thrust, and retort with something positive and verbal, than about the inner truth of things. (Bacon 2004, p. 99)²⁴

In this context, Bacon addresses the outcome achieved by Aristotle’s use of his general conviction that the mind naturally accesses things “as they are,” in the field of natural philosophy. In his view, Aristotle’s allegation only generates the production of a discourse actually disconnected from these things. Bacon accounts for Aristotle’s natural philosophy in terms of a discourse full of obscure conceptual distinctions which provide no knowledge at all of the way nature actually operates. For Bacon, this discourse’s emptiness and inconsistency are due to its composition according to the laws and to the conceptual parameters articulated in the *Organon*. Put differently, the verdict rendered by Bacon is that Aristotle’s physics results from the use of badly determined rules of reasoning. Nature can’t be elucidated by the resort to words which acquire their meaning from concepts incapable of referring to existing things and of accounting for them. Propositions can’t actually signify the true or the false, as they were supposed to do in Bacon’s time, if they rely on categorical predication: Aristotle’s belief that the assignation of something to certain ontological categories framed by the mind, makes sense from the viewpoint of logic,

24. “Primi generis exemplum in Aristotele maxime conspicuum est, qui Philosophiam Naturalem Dialectica sua corruptit; quum Mundum ex Categoriis effecerit; animae humanae, nobilissimae substantiae, genus ex vocibus secundae intentionis tribuerit; negotium densi & rari, per quod corpora subeunt maiores & minores dimensiones sive spatia, per frigidam distinctionem Actus & Potentiae transegerit; motum singulis corporibus unicum & proprium, & si participant ex alio motu, id aliunde moveri, asseruerit; & innumera alia pro arbitrio suo, Naturae rerum imposuerit: magis ubique sollicitus quomodo quis respondendo se explicet, & aliquid reddatur in verbis positivum, quam de interna rerum veritate” (Bacon 2004, p. 98).

amounts to disregarding the lack of continuity between the order of nature and the order of thought. Bacon's critical statement sets the new ontological and semantic framework for his logic. Not only is Aristotle's theory of substance discarded for its incapacity to address the subtle and complex materiality of nature.²⁵ But the conceptual apparatus built in connection with this theory is also presented as being deprived of heuristic value.

At stake here is a major philosophical change in the context of the Scientific Revolution. Bacon's redesign of the structure of things, concepts and words governs his interpretation of experiment in terms of a kind of reasoning. We propose that Bacon's approach to experiment as a solid and reliable form of reasoning is at the core of his articulation of his logic in terms of an art of interpreting nature.

To begin with, by pointing out that natural philosophy "has been infested and corrupted in Aristotle's school by logic" (*infesta & corrupta in Aristotelis schola, per Logicam* Bacon 2004, pp. 152–3), Bacon makes it clear that more solid groundings are required for logic to "interpret" nature and to stop "anticipating it":

For the sake of instruction I have grown used to calling human reasoning which we currently apply to nature *Anticipations of Nature* (because it is an impetuous and premature proceeding), whereas that reasoning elicited from things by proper means I call the *Interpretation of Nature*. (Bacon 2004, p. 75)²⁶

The way Bacon theorizes the operation of reasoning in this passage is remarkable. In this context, Bacon explicitly attributes to the term "ratio" the meaning of method, as he frequently does. But he goes further. While he also uses ratio as a way to refer to the act of reasoning properly speaking, he strikingly does not describe this act in psychological terms. He addresses it in the prospect of a formalization. As he claims that interpretation of nature consists in a "reasoning elicited from things by *proper means*," he provides a new definition of logic.

From that point on, once logic has been characterized in terms of an "art and rule of interpreting nature" (*ars et norma interpretandi naturam*) (Bacon 2004, pp. 172–3), it may resort to experiment and to natural history. In Bacon's view, the insertion of experiment and natural history within the framework of logic is even necessary, in so far as eliminative induction requires the organization of an activity of fact gathering. It is important to

25. Cassan forthcoming.

26. "Rationem humanam, qua utimur, ad Naturam Anticipationes Naturae, (quia res temeraria est & praematura), at illam Rationem quae debitis modis elicitor a rebus, Interpretationem Naturae, docendi gratia, vocare consuevimus" (Bacon 2004, p. 74).

highlight this aspect of the *Novum Organum's* approach to logic, which has been overlooked, in order to deepen our understanding of Bacon's treatment of experiment and natural history as tools designed for an adequate exploration of nature. In the past decades, light has been placed upon the claim of the *Historia Naturalis et Experimentalis* that the *Novum Organum* without the natural history would advance the sciences much less than natural history without the *Novum Organum*.²⁷ Among other things, this complex claim implies that in this book, Bacon is not providing a general theory of experimentation that can merely be applied in the case studies provided in the natural histories he published afterwards. So scholars made it clear that however crucial the *Novum organum* may be to the understanding of Bacon's natural philosophy, that book does not contain all of Bacon's ideas about methodology and epistemology. From this point on, reconstructions of Bacon's theory of experimentation from the place of his natural histories began, giving rise to discussions about the problematic structure of Bacon's answer to the logic of discovery.²⁸ Nonetheless, so far, the way according to which Bacon formalizes experiment in the *Novum Organum*, in connection with the reshaping of logic he undertakes in this book, hasn't been precisely described. This is our purpose here: to focus on this book and on its contribution to Early Modern logic.²⁹

We suggest, first, that the centrality given to experiment in the *Novum Organum* is the outcome of the redesign, in this book, of a reshaping of the semantic relationship between things, concepts, and words, which leads Bacon to state as a principle that he is concerned with building reasonings not abstracted from things, but connected to them. Bacon puts on experiment the label of "by far the best demonstration [...] so long as it sticks to the actual experiment" (*demonstratio longe optima est Experientia; modo haereat in ipso experimento*) (2004, p. 110). In this passage, by referring to the logical concept of demonstration, he claims that scientific knowledge of phenomenal reality (*experientia*) is obtainable through a certain form of experimentation

27. "Itaque huc res redit, ut Organum nostrum, etiamsi fuerit absolutum, absque Historia Naturali, non multum; Historia Naturalis absque Organo, non parum, Instaurationem Scientiarum sit propectura" (Bacon 2007, p. 12). Bacon's accumulation of natural history materials has been presented as the "second manifestation" of his philosophy (See Rees 1996, p. 121).

28. See in particular Rusu 2013, Jalobeanu 2015.

29. We don't interpret Bacon's philosophical agenda after 1620 in terms of a rejection of the *Novum Organum's* more formal attempts as building a method for his natural philosophy. We rather address it in terms of an evolution generated by Bacon's need to actually confront himself with the phenomena. More than that, we suggest that Bacon's understanding of the semiotic triangle in the *Novum Organum* paves the way for the third part of the *Instauratio Magna*, in so far as it undermines the Aristotelian concept of substance.

(*experimentum*).³⁰ Differently put, Bacon equates experiment with a specific kind of reasoning, providing absolute certainty.³¹ He affirms the probatory function played by facts.

We suggest, in addition to this, that the complexity of Bacon's approach to experiment in the *Novum Organum* can even be accounted for as illustrating a constant concern with showing the necessity of departing from Aristotle's understanding of the relation between things, words, and ideas, in so far as it would allow for the building of purely verbal reasonings. It is well-known that Bacon's remarks about the "blindness" and "stupidity" of "the means of gaining experience now in use" (*modus experiendi, quo homines nunc utuntur, caecus est et stupidus*) (Bacon 2004, p. 110) are followed by propositions for a new *modus experiendi*. But the exact features of the appropriate method set out in the *Novum Organum* in order to properly experiment are not that well known so far. To be sure, the main operational concepts and techniques articulated by Bacon in this context have been identified. But it has to be remarked that although these concepts and techniques do not embody a systematic experimental protocol, the operations they formalize are connected to each other, in so far as they contribute to induction. In other words, taken separately as well as together, these tools fulfill the methodological demand Bacon grounds his logic on: to truly acquaint the mind with things relating to the subject under investigation.

Such is the case because the design of these tools as ways of facilitating access to experience is based on a reappraisal on Aristotle's approach to semiotics. A general outline makes it clear. Bacon begins with claiming that the foundations of experience have to be reinforced and that natural history has to be better instructed accordingly (*historia naturalis [...] melius instructa*) (Bacon 2004, pp. 156–7). He designs *experientia literata* to put discoveries in writing and to make them flourish (*ex ipsa traductione experientorum unius artis in alias, multa nova inveniri possunt, ad humanam vitam et statum utilia, per istam experientiam quam vocamus literatim*) (2004, p. 160).³² He promotes *luciferum experimentum*, whose generation, facilitated by *experientia literata*, contributes to the discovery of causes and axioms, a more valuable thing, in Bacon's view, than *fructiferum experimentum* (2004 pp. 112, 156–8, 180). He conceives three tables of invention (*inventionis*

30. For discussions about the distinction between *experientia* and *experimentum* see Deleule 1984; Manzo 2001; Fattori 2002; Rusu 2013.

31. For an account of Bacon's approach to certainty see Manzo 2009—"Bacon's project suggests in theory that the obtaining of absolute certain knowledge is possible but in fact such knowledge is revealed to be impossible" (p. 137).

32. In the *Advancement of Learning*, Bacon presents *experientia literata* as "a degree and rudiment" of interpretation of nature (Bacon 2000, p. 111). On this issue, see Jardine's seminal paper (Jardine 1990).

tabulas) so as to order data and to confront the intellect to first-hand experience of specific phenomena. He poses twenty-seven structured sets of instances with special powers (*prerogativas instantiarum*), which are labor saving devices helping the intellect gain information about nature and operate on it.³³ Bacon's multi-layer approach to experimental reasoning reveals that the principle of his logic lies in his conviction of the irreducibility of nature to how it is immediately perceived, and in his correlative conviction of the necessity to collect as many data as possible in order to gain a glimpse of the nature's operations.³⁴ His efforts to deal with the irreducible gap he takes to exist between what reality consists in and what the mind perceives of it, show that his dismissal of Aristotle's approach to the relationship between things, concepts and words plays a structural part in the shaping of his natural philosophy.

In the end, the *Novum Organum's* redefinition of the function and of the conceptual operators of logic makes this book a conceptual matrix for the development of Early Modern logic and Early Modern philosophy. Descartes, Malebranche, or Locke, make use of Bacon's claim that logic, taken as a discipline, should teach how to investigate things and how to access truth, rather than how to conduct a disputation. Their resort to Bacon permits them to stand out from the Aristotelian logicians of the period who, obviously, also think that logic helps in the investigation of things (as well as, perhaps, in conducting disputations). The point is that Bacon and his successors disagree that logic could achieve this goal. Descartes, Malebranche, or Locke may discuss the rules for reasoning actually built by Bacon, because they may not share his theories of mind and of science, which account for them. But they share his concern with the determination of the process of a valid inference and his conviction that the Aristotelians' approach to the semiotic triangle has to be dismissed. So these two issues, which belong to the field of logic as it is shaped by Bacon in the *Novum Organum*, contribute to the building of Early Modern philosophy.

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33. Jalobeanu 2011.

34. Giglioni 2013b, p. 410.

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