The Dutch fates of Bacon's philosophy: *libertas philosophandi*, Cartesian logic and Newtonianism

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Even if there is not, properly speaking, a school following Francis Bacon's agenda, his influence has been longstanding in Europe, at least until d'Alembert's *Discours préliminaire* to the *Encyclopédie* (1751). D'Alembert proposes a taxonomy of human knowledge based on the threefold division of mental faculties introduced in Bacon's *De augmentis scientiarum*[1]. Well before d'Alembert, however, Bacon's philosophy deeply influenced continental philosophy. Indeed, it provided some solutions to the problems raised by Cartesian philosophy, which was taught in the Dutch universities. The works of Bacon had more editions in the Netherlands than in England[2]: not surprisingly, as in seventeenth century the Dutch Republic enjoyed more intellectual freedom than any other country (with

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[1] Cfr. *Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers*, 1, Paris 1751, pp. XLVII-LIII; F. Bacon, *De augmentis scientiarum*, Londini 1623, b. 2, ch. 1, § 1. Father Berthier accused Diderot of plagiarism of Bacon's positions, cfr. *Journal de Trévoux*, 1751, 1, pp. 188-9; 2, pp. 302-27. For Diderot's answer, cfr. the letter to Father Berthier of the 2nd of February 1751, in D. Diderot, *Oeuvres complètes*, 13, edd. J. Assézat, M. Tourneux, Paris 1876, pp. 168-70.

[2] Cfr. R.E. Schofield, *Mechanism and Materialism: British Natural Philosophy in an Age of Reason*, Princeton 1970, pp. 135-6. Alberto Elena counts 41 Bacon's editions in the Netherlands up to 1700, and two Dutch translations: F. Bacon, *De Proef-Stucken, midtgaders, sijn heylige meditatien, en de wijsheyt der ouden*, tr. by P. Boener, Leiden 1646[1], 1647[2], 1649[3] (as *Politiicke en de andere daftige bedenckingen*, Leiden), 1649[4] (as *Heylige meditatien en essayes. En nu op nieus hier noch by gevoegt een tractaetjen van sijn coleuren en apparentien van goet en quaet*, Rotterdam); Id., *Nieuwen Atlas ofte beschrijvinge van het noyt meer gevonden Eylandt van Bensalem*, tr. by J. Williaemson, Dordrecht 1656. Cfr. A. Elena, *Baconianism in the Seventeenth-Century Netherlands: A Preliminary Survey*, «Nuncius. Annali di Storia della Scienza», 6, 1991, pp. 33-47.

the possible exception of Venice)[3]. However, it may cause some surprise that the success of Bacon's thought in the Dutch context is also due to the dissemination of Cartesian philosophy in the universities. The problems raised by Descartes's system were often faced from a Baconian perspective: it is the case of the replacement of Aristotelianism, of the problem of error, of the quest for a new logic, and of the use of experience in science. Besides the large number of editions, therefore, we must consider the presence of Baconian arguments in many theories of the Dutch Cartesians.

Attention has been paid to the first diffusion of Bacon's thought in the Netherlands by Paul Dibon, Alberto Elena and Reijer Hooykaas, who have analysed in detail the role of Jan van Brosterhuysen, Isaac Beeckman, Henricus Reneri, Constantijn and Christiaan Huygens[4]. More recently, Mark Aalderink has pointed out the relevant connections between Geulincx's and Bacon's criticism of Aristotelian errors[5]. These studies have remarkably outlined the channels by which Bacon's philosophy was introduced in the Netherlands and have shown some influence of his thought. My aim is to generalize their results by considering the actual causes of the rapid spread of Bacon's philosophy in the Dutch Republic.

1. *A Baconian reform in the Netherlands*

The introduction of Cartesian philosophy in the Dutch universities[6] was

[3] Cfr. H.H. Rowen, *The Dutch Republic and the Idea of Freedom*, in *Republicanism, Liberty, and Commercial Society, 1649-1776*, Stanford 1994, pp. 310-40, and D. Wootton, *Ulysses Bound? Venice and the Idea of Liberty from Howell to Hume*, *ibid.*, pp. 341-67.

[4] P. Dibon, *Sur la réception de l'oeuvre de Bacon en Hollande dans la première moitié du XVII^e siècle*, in *Francis Bacon. Terminologia e fortuna nel XVII secolo*, Atti del convegno, Roma 1984, pp. 91-115; Elena, *Baconianism in the Seventeenth-Century Netherlands*; R. Hooykaas, *De Baconiaanse Traditie in de Natuurwetenschap*, «Algemeen Nederlandse Tijdschrijft van Wijsbegeerte», 53, 1961, pp. 181-201. Cfr. also S.B.L. Penrose, *The Reputation and Influence of Francis Bacon in the Seventeenth Century*, New York 1934, and R.F. Jones, *The Bacon of the Seventeenth Century*, in *Essential Articles for the Study of Francis Bacon*, Hamden 1968, pp. 3-27.

[5] M. Aalderink, *Philosophy, Scientific Knowledge, and Concept Formation in Geulincx and Descartes*, Utrecht 2009.

[6] For the relevant context, cfr. J. Bohatec, *Die cartesianische Scholastik in der Philosophie und reformierten Dogmatik des 17. Jahrhunderts*, Leipzig 1912; P. Dibon, *La Phi-*

justified in two ways. It was presented as a part of an ancient wisdom, showing that its introduction was no radical novelty. Secondly, it was introduced as the cultural counterpart of the independence of the Republic. As it offered a program for the renewal of philosophy and education, Bacon's thought found in the Dutch Republic a sensitive audience. For they were offering a consistent system of knowledge, after Melanchton's reformation (which had in the Philippo-ramistic logic its most fruitful result) Bacon's *Instauratio magna* and Descartes's *Principia philosophiae* were seen as a the most fruitful options for a new *corpus* of philosophy in the protestant universities. At the time of Descartes and even before it, Bacon's project of a philosophical and a civil reform made him the ideologue of this renewal. The first Dutch Cartesians, Adrian Heereboord (1613-61) and his pupil Johannes De Raey (1620-1702), used his philosophy to uphold the change.

At Descartes's time renewal in philosophy was double faced. It was conceived as the introduction of a new thought and as the rediscovery of the timeless truth acknowledged by the wise men of every century. This rediscovery was thus also an emendation of the established paradigm. In the case of De Raey, it was just a seeming emendation of Aristotelianism, as in his *Clavis philosophiae naturalis* (1654) he tries to adapt Aristotle's philosophy to Cartesian standards[7].

As far as Heereboord is concerned, however, it is possible to recognize a more substantial intention to emendate the current philosophy. He promotes a rediscovery of the ancient philosophy pursuing the same project of Reformation in the rediscovery of the uncorrupted Christianity, «intra-

losophie néerlandaise au siècle d'or, 1: *L'enseignement philosophique dans les Universités à l'époque pre-cartésienne (1575-1650)*, Paris-Amsterdam-Londres-New York 1954; E.G. Ruestow, *Physics at Seventeenth and Eighteenth-Century Leiden: Philosophy and the New Science in the University*, The Hague 1973; C.L. Thijssen-Schoute, *Nederlands Cartesianisme, avec sommaire et table des matières en français*, Amsterdam 1954; T. Verbeek, *Descartes and the Dutch. Early Reactions to Cartesian Philosophy, 1637-1650*, Carbondale and Edwardsville 1992; Id., *Dutch Cartesian Philosophy*, in *A Companion to Early Modern Philosophy*, Oxford 2002, pp. 167-82; W. van Bunge *et al.* (edd.), *The Dictionary of Seventeenth and Eighteenth-Century Dutch Philosophers*, Bristol 2003.

[7] J. De Raey, *Clavis philosophiae naturalis, seu introductio ad naturae contemplationem, aristotelico-cartesiana*, Lugduni Batavorum 1654, 1677[2] (as *Clavis philosophiae naturalis aristotelico-cartesiana. Editio secunda, aucta opuscolis philosophicis varii argumenti*, Amstelodami). Cfr. *infra*, note 10.

vit academiarum apud reformatos limen religio purior, impurior tamen remansit philosophia»[8]. In his *Meletemata philosophica* (1654) Erasmus, Luther and Melanchton are introduced as the champions of this enterprise[9]. De Raey, on the contrary, considered Aristotelianism a paradigm to be replaced, assuming a more confident position toward the revolutionary role of Descartes's philosophy[10]. Heereboord, indeed, adopted Cartesianism in his later years, whereas De Raey was educated as a Cartesian. Their views left however space for using Bacon as the symbol of freedom in philosophy. In Heereboord's disputation *De principiis corporum naturalium constituentibus et producentibus*[11] Bacon is associated with Comenius in reforming Aristotelianism. His aim is clear, he is not looking for a replacement of the old paradigm:

idoneo medio ac remedio, quod fiet si ad sensuum, rationis, ac scripturae dictamen, philosophemur, et philosophiam peripateticam ac scholasticam, multis par-

[8] *Ad curatores epistola*, in A. Heereboord, *Philosophia naturalis*, Nijmegen 1665[5] (1654[1], as *Meletemata philosophica*, Lugduni Batavorum), p. 6.

[9] «Densissimis istis tenebris nova lux affulsit […] Dante Aligerio et Francisco Petrarcha, primis philosophiae, bonarum artium, et omnis eruditionis restauratoribus […]. Impetiit Germaniam hoc lumine primus Rodolphus Agricola, aeternum Belgii decus, qui acrius quaedam, adversus receptum philosophandi modum, socratica dixit libertate. Exinde plures purgando Augiae stabulo manus auxiliares admovere: prae caeteris, Hollandiae nostrae ac totius orbis miraculum, Desiderius Erasmus, Martinus Lutherus, Philippus Melanchton, primi apud nos religionis simul et philosophiae restauratores» (Heereboord, *Philosophia naturalis*, p. 5). Cfr. also Dibon, *Sur la réception de l'oeuvre de Bacon*, p. 106. On Heereboord as a Scholastic, cfr. H. Krop, *La scolastique élusive. Les traces de la scolastique dans l'Ethique*, in *Spinoza et ses scolastiques: retour aux sources et nouveaux enjeux*, Paris 2011, pp. 15-30.

[10] Cfr. his *De Aristotele et aristotelicis*, in De Raey, *Clavis philosophiae naturalis aristotelico-cartesiana. Editio secunda*, pp. 201-36: «quasi, ut in religionem reformatio cadit, quae multum adhuc sani habebat, sic cadere reformatio in philosophiam possit, in qua nihil sani est. […] Enim eam reformare, ubi melior iam inventa est, quae suam per se habet formam, […] forte inutile sit atque etiam difficile et vix possibile: id dici non potest ex eo contingere, quia nihil in ea sani reliquum sit, verum quia ea quae sunt sana, novam formam non admittunt» (p. 219). Cfr. A. Strazzoni, *La filosofia aristotelico-cartesiana di Johannes De Raey*, «Giornale critico della filosofia italiana», 31, 2011, pp. 107-32.

[11] Heereboord, *Philosophia naturalis*, pp. 141-6.

tibus defectam, multis modis intricatam, multa vocum barbarie foedam, multis ambagibus prolixam, multis opinionibus erroneam, multis assertionibus infrugiferis repletam, reformemus, emendemus, restauremus, quod faciendum esse et quomodo […] Comenium in praefatione sua physicae et prodromo pansophiae atque illustrem Verulamium in Instauratione magna et Augmentis scientiarum[12].

Heereboord's solutions were close to those of the Humanists and the Renaissance philosophers. In his *Meletemata* he presents – in his typical eclectic way – Dante and Petrarca as the first discoverers of the ancient wisdom[13], followed by Valla, Giovanni and Giovanni Francesco Pico, Vives, Ramus, Telesio and even modern Scholastics as the Conimbricenses[14]. The use of Bacon is cautious: in fact, if Heereboord can rely on him in developing a radical criticism against scholastic errors, at the same time he is perfectly aware that Bacon's empirical and qualitative physics could fit the traditional *curriculum* more than Descartes's system.

Actually, Heerebord suggests a link between Descartes's methodical doubt and Bacon's struggle against *idola* in his *Epistola ad curatores* of *Meletemata*[15], where he mentions Bacon in his outlook on the role of doubt in philosophy, the «indubitatae philosophiae initium»[16]. In his

[12] *Ibid.*, p. 144. Comenius tried to apply in England a Baconian reform of studies, along with Samuel Hartlib and John Dury, friend of Reneri and Heidanus. As he came to the Netherlands in 1613, 1626 and 1642, he tried to propagandise such a reform also in the Dutch Republic, cfr. W. van Bunge, *From Stevin to Spinoza: An Essay on Philosophy in the Seventeenth-Century Dutch Republic*, Leiden-Boston 2001, pp. 35-6.

[13] Cfr. *supra*, note 9.

[14] Cfr. *Disputatio de libertate philosophandi*, in Heereboord, *Philosophia naturalis*, pp. 332-3. In *Epistola*, however, he criticises the Conimbricenses as a Scholastic sect (p. 6).

[15] *Ibid.*, pp. 1-20.

[16] *Ibid.*, p. 12. Cfr. also «ipse dubitandi actus firmissimum indubitantis est philosophiae principium. […] renunciandum esse omnibus mentium nostrarum idolis, eradicandas esse opiniones praeconceptas, tollenda omnia praeiudicia, et animum ad philosophiam esse adferendum, qualis est infantis, in quo nihil pictum est aut fictum aut scriptum actu, sed quidvis fingi, pingi, scribi in eo potest; hanc fuisse viam tritam ac calcatam Aristoteli et praeclaris semper omnium seculorum ubivis gentium ingeniis, ac nostro aevo illustri D. Verulamii in aureo opere Instaurationis magnae et de Augmentiis scientiarum, atque etiamnum ter et calcari ingenio incomparabili, veritatis ex caligne et servitute emergentis promotori unico, D. Renato Cartesio, a quo heroe si semel didicerimus moderari ac cohi-

Consilium de ratione studendi philosophiae[17], moreover, Bacon is credited as the builder of a system, not just as a confuter of the errors of Scholastics (as Vives, Ramus, Patrizi, Gorlaeus, Campanella, Telesio, Basso and the Boot brothers were). He is considered along with Comenius, Patrizi, Digby and Descartes among those who «veriora indagandae veritatis fundamenta iaciunt»[18]: but being more open to an empirical understanding of nature he is considered less concerned with an intellective foundation of science. Indeed, Heereboord proposes a Baconian way of investigation of nature – opposed to Scholastic bookish dogmatism – emphasizing the role of senses, experiences and induction: «ratio […] petit ac colligit […] ad […] inventionem, quatuor […] instrumentis, sensu, observatione, inductione, experientia»[19]. This investigation, following Bacon's attitude, is also seen as a source for everyday practice[20].

This position was not De Raey's: in the same years, in fact, he defended the distinction between practical and philosophical knowledge[21]. Like Heereboord, however, he quotes Bacon's words in order to support the reform of studies. As a professor De Raey pays attention to the political

bere mentis nostrae assensum an iis de quorum veritate non certo constat, et mentem nostram ab omnibus praeiudiciis liberare, tum demum ista animi, ista iudicii inaestimabilis libertas, reducta nobis fuerit ac restituta; tum demum praesidia et auxilia inventa fuerint errores praecavendi, veritatem eruendi, philosophia ad suam libertatem et perfectionem reducendi ac restituendi» (p. 13).

[17] *Ibid.*, pp. 27-8.

[18] *Ibid.*, p. 28. The list will appear in Gerard De Vries's *Introductio historica ad Cartesii philosophiam*, Traiecti ad Rhenum 1683-86, thesis 14. Cfr. Dibon, *Sur la réception de l'oeuvre de Bacon*, pp. 101-2.

[19] *De encyclopedia*, in Heereboord, *Philosophia naturalis*, p. 334.

[20] «Excutiamus tandem pulverem ex oculis nostris, nec in uno haereamus Aristotele, non Aristotelis tantum sed naturae scholam ingrediamur, non Aristotelis tantum sed naturae codicem aperiamus, non illius tantum sed huius praesertim folia evolvamus, et, ut uno verbo veram philosophandi rationem ob oculos ponam, ipsam rerum naturam adoriamur, istic causas inquiramus, inventas observemus, observatas aliis experientiis probemus, probatas ad vitae humanae usum referamus atque applicemus, et sic in natura, naturae opificem, potentissimum, sapientissimum, optimum, miremur, cognoscamus, celebremus» (*ibid.*, p. 6).

[21] Cfr. J. De Raey, *Oratio inauguralis de gradibus et vitiis notitiae vulgaris circa contemplatione naturae et officio philosophi circa eandem*, Lugduni Batavorum 1651.

and religious relevance of the innovation. The official teaching should refrain from fealing with the Scholastic thought anymore, as this is deeply rooted in Roman catholicism: «purior et a romani pontificis tyrannide in libertatem asserta religio, ad quam purior ac libera philosophia summe necessaria est»[22]. In order to justify the adoption of a new philosophy he appeals to *Advancement of Learning* and quotes a rule concerning the value of civil laws in his *Epistola dedicatoria*:

in mentem primum venit civilis prudentiae canon, a Verulamio libro II de Aug. scientiarum Jacobi Magnae Britanniae, etc. regi adscriptus. *In omni*, inquit, *vel consuetudine vel exemplo tempora spectanda sunt, quando primum res coepta; in quibus si vel confusio regnaverit, vel inscitia, derogat illud imprimis athoritati rerum, atque omnia suspecta reddit*[23].

This civil canon is shifted into philosophical terms, as it is applied to Aristotelian philosophy:

[22] De Raey, *Clavis philosophiae naturalis*, p. xii. In the dedicatory letter he addresses the *Curatores* with these words: «verum quotquot amplitudinis vestrae mandato, in hac celeberrima toto orbe et cum ipsa reipublicae libertate nata atque educata academia philosophiam docent, […], vobis immortales debent gratias, quod, expulsa primum e republica et ecclesia hispanicae gentis ac romani pontificis tyrannide, prudentissimo consilio cavere dignati fueritis, ne dura et pernitiosa ella ingeniorum servitus, a qua sub arabum ac scholasticorum dominatione primum philosophia ac dein etiam theologia ac medicina, cum plerisque aliis humanioribus scientiis, si non extintae, misere saltem fatigatae ac oppressae aliquot seculis iecerunt, in hanc academiam vestram, quae publicum restitutae in integrum libertatis trophaeum est, ullo inquam tempore locum inveniret» (p. xvi).

[23] *Ibid.*, p. ii. Cfr. F. Bacon, *The Advancement of Learning*, ed. W.A. Wright, Cambridge 1866, pp. 80-1: «another defect which I note is an intermission or neglect in those which are governors in universities, of consultation, and in princes or superior persons, of visitation: to enter into account and consideration, whether the readings, exercises, and other customs appertaining unto learning, anciently begun and since continued, be well instituted or no; and thereupon to ground an amendment or reformation in that which shall be found inconvenient. For it is one of your Majesty's own most wise and princely maxims, that in all usages and precedents, the times be considered wherein they first began; which if they were weak or ignorant, it derogateth from the authority of the usage, and leaveth it for suspect».

Satis habebo, impraesentiarum obiter ob oculos posuisse, *in consuetudine et exemplo*, aristotelicam philosophiam in academiis docendi, *tempora spectanda esse, quibus id primum coeptum est, iisque tantam confusionem, inscitiam* ac tyrannidem *regnasse, ut multum id deroget* adeo antiquae consuetudinis *autoritati, atque omnia suspecta reddat*. Hunc vero et in privatis et in publicis negotiis rite administrandis adeo necessarium prudentiae canonem, etiam ab Academiarum Curatoribus iam longo tempore observatum, ac speciatim quoque receptae philosophiae aristotelicae applicatum fuisse, negari non potest[24].

De Raey addresses the Curators of the University – the *burgemeester* and other public personalities – with a political message. In fact, he tries to introduce Cartesianism speaking to the Curators in their own language. For Descartes was always cautious on the political and religious consequences of his philosophy, his books could not have been De Raey's source[25]: he borrowed it from Bacon.

Actually, the Baconian way to adopt a new science is dealt with also by Johannes Clauberg (1622-65)[26], De Raey's pupil at Leiden university. In his *Initiatio philosophi sive dubitatio cartesiana* (1655)[27], after having praised Descartes's attitude toward Bacon contained in *Les passions de l'âme*[28],

[24] De Raey, *Clavis philosophiae naturalis*, pp. xi-xii. The 'political' justification of the introduction of Cartesianism, however, is not the only one in De Raey's works. He mainly supports his view showing how Cartesianism can be seen as a rediscovery of the ancient wisdom.

[25] In his later years De Raey will try to show that Descartes never proposed a reform of studies, cfr. *Disputatio philosophica specimen exhibens modestiae et prudentiae in philosophando* (1687), in J. De Raey, *Cogitata de interpretatione: quibus natura humani sermonis et illius rectus usus, tum in communi vita et disciplinis ad vitae usum spectantibus, tum in philosophia, ab hujus seculi errore et confusione vindicantur. Accedunt notae recentes ad partem primam generalem, cum appendice ex olim scriptis, propter cognationem*, Amstelodami 1692, pp. 632-54.

[26] On the use of Bacon by Clauberg, cfr. M. Savini, *L'insertion du cartésianisme en logique: la* Logica vetus & nova *de Johannes Clauberg*, «Revue de Métaphysique et de Morale», 49, 2006, pp. 73-88. Clauberg's works are collected in *Opera omnia philosophica*, Amstelodami 1691.

[27] Or the the introduction to Cartesian philosophy through the eradication of prejudices. Cfr. *De initiatione philosophi, Prolegomena*, § 7, quoting F. Bacon, *Novum Organum*, Londini 1620, 1, aph. 68, Clauberg, *Opera*, pp. 1125-9.

[28] R. Descartes, *Oeuvres*, 11, edd. C. Adam, P. Tannery, Paris 1909, p. 320.

Clauberg compares the Cartesian doubt to that of Bacon[29] by commenting Gerard de Neufville's *Physiologia* (1645). He shows that de Neufville's criticisms to Bacon's eradication of prejudices, or the beginning of the new science on the ground of a mind deprived of all its contents[30], were not aimed against Descartes, for their positions on doubt were different[31]. Both wanted to begin their philosophy through an emendation[32], but Bacon's method could bring some excesses that are not implied by Descartes's doubt:

quae deinceps enarrantur verulamianae methodi incommoda, ea cartesianam minime comitantur. Nam […] in cartesiana dubitatione certitudo involvitur atque implicatur, qua dubitans suam illico naturam agnoscit, unde in Dei et porro in rerum a Deo creatarum notitiam devehitur. […] Ac proinde cartesiana methodus scholasticae institutioni maxime accomodata est. […] Porro cartesiana dubitatio metaphysica est, verulamiana physica: illa ratiocinatione et intellectuali attentione, haec sensuum observatione et experimentis […] tollitur: ab illa liberamur per brevem a posteriori demonstrationem (ut cum ex dubitatione percipimus nos dubitantes existere […]) ab hac per longam inductionem ex particularibus praemissis et experimentis[33].

[29] Clauberg, *Opera*, pp. 1212-6.

[30] «Auctor (Bacon) ad intepretationem naturae, requirit mentem puram hoc est, ab omnibus praeconceptis opinionibus seu idolis, ut loquitur, liberatam atque expurgatam, […] ut lib. I Organi Novi aph. 68 idem innuit […]; nihil est , quod in hac sententia improbare possimus […]. At si haec sit sententia, omnia ea, quae hucusque hominum labore atque industria inventa et tradita sunt circa rerum naturalium cognitionem et scientiam, absque ullo discrimine penitus reiicienda atque animo excludenda esse, […] omnino eam probare neutiquam possumus. […] Protestatur quidem illustris Verulamius, in praefat. Organi novi, et lib. I eiusdem aphor. 128 sibi minime propositum esse, artes et scientias, quibus utimur, destruere et demoliri» (*ibid.*, pp. 1212-3). Cfr. Bacon, *Novum Organum*, 1, aphs. 68, 128, as well as *Praefatio*.

[31] «Adscribam autem primum doctissimi et affinitate mihi iuncti praeceptoris Gerhardi de Neufville, censuram verulamianae dubitationis, ex praefatione Physiologiae excerptam et in articulos digestam, ac deinde ostendere conabor, nihil eam facere contra dubitationem cartesianam, propter utriusque discrepantiam evidentissimam» (Clauberg, *Opera*, p. 1212).

[32] *Ibid.*, p. 1214, §§ 20-1.

[33] *Ibid.*, p. 1214.

Bacon's approach on prejudices could be more dangerous than Descartes's metaphysical doubt, as it concerns not just the attention of mind but all the experiences which have to be repeated to be confirmed. Actually, Clauberg opposes a radical change in the curriculum[34]. Bacon's program is thus seen as a radical renovation of arts. The large amount of experiences collected until that time cannot be ignored for the sake of a new science. However, we find a more positive use of Baconianism in the reformation of knowledge in Clauberg's *Differentia inter cartesianam et alias in scholis usitatam philosophiam* (1679), which follows De Raey's approach on the corruption of the Aristotelian philosophy[35] and proposes a Baconian renovation of studies[36]. In *Logica vetus et nova* (1654), moreover, Bacon's positions are assumed for a more realistic comparison between the ancients and the moderns, against any uncritical acceptance of tradition or novelty:

accedit vel antiquitatis amor nimius, vel novitatis studium ardentius, quam par est, cum antiqua, non quia antiqua, neque nova, quia nova, sed quod vera deprehensa, amplecti solum deceat. Et quod aliquando verum est de alicuius rei natura, semper de ea verum est, sive nuper hominibus innotuerit, sive diu fuerit perspectum[37].

As in the case of De Raey, for Clauberg also Bacon's philosophy represents a middle step in the changes of paradigm in seventeenth century.

[34] «Ut prioris qualitatis et formae nonnhili initio remaneat et paulatim aboleatur, utile est in mutatione physica, […] in mutatione politica […] et si simili modo vetus philosophia a Cartesio potuisset reformari, forte minor fuisset strepitus, minor ad calumniandum ab adversariis inventa occasio» (*ibid.*, p. 1215).

[35] «Me cartesianam philosophiam scholasticae opposuisse, non vero aristotelicae, qualis illa est in se […] siquidem demonstrari potest, hanc in multis capitibus cum cartesiana magis quam cum scholastica consentire, id quod excellentissimus philosophus Johannes de Raey in Clave philosophiae naturalis in multis ostendit» (*ibid.*, p. 1234).

[36] «Denique innovationem in rebus philosophicis quod attinet, existimo illum qui ratione sua recte uti voluerit, et inprimis cui academiarum salus curae est, non facturum quicquam operae pretium ab officio suo alienum, si recta secum via reputet probeque consideret […] verba […] Francisci de Verulamio summi Angliae cancellarii Novi Organi lib. I aphor. 90» (*ibid.*, pp. 1234-5). Cfr. Bacon, *Novum Organum*, 1, aph. 90.

[37] Clauberg, *Opera*, p. 778. Cfr. Bacon, *Novum Organum*, 1, aph. 56; Savini, *L'insertion du cartésianisme en logique*,p. 87.

His appeal to experience is meant to keep some of the Aristotelian positions in the new paradigm. However, as De Raey points out[38], Clauberg's attitude seems more conciliative with the old paradigm than that of De Raey himself.

2. *Cartesian philosophy and Baconian history*

De Raey not only understood the social message of Bacon, but his thought was also used to unveil the causes of Scholastic errors and to reform practical disciplines, which, according to him, had to go along with philosophy reduced to physics and logic[39]. In fact, De Raey was trying to emendate the official philosophy through a Baconian critic of Scholastic errors, and the practical arts by the introduction of a Baconian natural history. If he was on more radical positions than Heereboord's, he however inherited from his master an eclectic approach. Indeed, Heereboord adopted a new natural philosophy, but in the other disciplines he was still embracing Franco Burgersdijk's Aristotelianism. De Raey's eclectic approach, however, has a strong philosophical reason as his main end is to separate *philosophia* and *historia*, or Cartesian physics from all the other disciplines[40]. According to him the end and the method of philosophy are different from those of the other disciplines (the upper and the mechanical arts), as these are *ad usum vitae*, whereas philosophy is aimed to the discovery of truth. Therefore, arts can follow a pragmatic approach according to which things are not considered in themselves but in their relation with us, that is, through experience.

As a scholar, De Raey shares the view that if a philosophical system is aimed to replace the old one it has to deal with its foundation and preconditions. Thus his interests are more on the causes of Scholastics' errors

[38] De Raey, *Cogitata*, pp. 658-9.

[39] Cfr. *Pro vera metaphysica*, in De Raey, *Clavis philosophiae naturalis aristotelico-cartesiana. Editio secunda*, pp. 412-39; *De constitutione logicae*, *ibid.*, pp. 707-13; *De constitutione physicae*, *ibid.*, pp. 714-20.

[40] This point will be fully developed in his later years, however, it is present from the beginning of his academic career. Cfr. T. Verbeek, *Les cartésiens face à Spinoza: le cas de Johannes de Raey*, in *The Spinozistic Heresy. The Debate on the* Tractatus Theologico-Politicus*, 1670-1677 and the Immediate Reception of Spinozism*, Acts of international seminar, Amsterdam-Maarssen 1995, pp. 77-88.

than on their arguments, as he wants to outline their gnoseological roots. Anyway, Descartes did not go beyond a general consideration of will and of the prejudices of childhood in his discussion concerning the source of self deception. Therefore, De Raey found in Bacon's articulated, genealogical criticism to the *idola tribus*, *specus*, *fori* and *theatri* a solution to this problem. In his *De cognitione vulgari et philosophica* (1651), *De vero et falso* (1667, 1668) and *De origine erroris* (1666) he provides the Cartesian system with a *pars destruens* against its adversaries. It is the case of the attribution of sense data to external bodies, as we are unaware of their actual cause[41]. Such an error goes along with the theory of *homo mensura*, or the consideration of things only in their good or bad relation to us[42]. This is a Cartesian perspective, as it comes from the distinction of soul and body: however, the kind of criticism he provides is that of Bacon's *idola tribus*. De Raey finds in the recognition of secondary qualities (and of occult powers also, revealing only our ignorance on the causes of phenomena)[43], the features of the Aristotelian *notitia vulgaris*, that has not to be mixed with philosophy as it is *ad usum vitae*[44]. In fact, he criticizes the use of vulgar

[41] «Porro advertentes, non pro arbitrio nostrae voluntatis, verum citra animi consensum nobis plerumque advenire istas sensuum perceptiones, eas etiam, non a nobis solis effictas, verum a rebus aliis extra nos existentibus sensui impressas esse iudicavimus» (De Raey, *Clavis philosophiae naturalis*, p. 11).

[42] «De aliis corporibus […] secundum effectum iudicamus: sive effectus ille tantum in sensu, sive in alio commodo vel incommodo consistat. […]. Qua ratione, ut aliorum corporum effectus in nobis videtur duplex esse, vel bonus et conveniens nobis, qui saepe in solo sensu consistit, vel malus et non conveniens, quo etiam privatio sensus refertur; et ut unus tanquam habitus et perfectio, alter ut privatio et imperfectio spectatur» (De Raey, *Cogitata*, pp. 531-2).

[43] «Philosophi occultas vocant eas qualitates quarum quidem aliqua effecta vel operationes videmus, intimam vero naturam sensu non attingimus: talesque sunt apud ipsos vires magnetis, peoniae, rhabarbari et pleraque naturales agendi potentiae, quas idcirco sensu non obvias esse docent. Sed […] quae […] est manifesta illa notitia quam de qualitate, quae afficit sensum, evidentiorem habet vulgus quam de vi magnetica? Annon uti ignem calefacere, et comburere […] annon ita, inquam, magnetem ferrum ad se allicere, paeoniam comitialem morbum curare et rhabarbarum purgare, sensuum experimento constat?» (De Raey, *Clavis philosophiae naturalis*, p. 24).

[44] «Eodemque modo notatum etiam fuit, quid herbae, quid mineralia, quid variae animalium partes, quid denique innumerabilis illa corporum quae nos circumstant multitu-

knowledge in philosophy but also its errors, which require an emendation as they characterize a primitive form of practical knowledge. De Raey's approach on Bacon is twofold: he adopts a Baconian perspective in his criticism of error, but also as a guidance for a more reliable *historia*. The way to get a new *historia*, however, is the same criticism of error which is adopted in philosophy.

We can recognize this double approach in his criticism to that sort of Scholastic 'practical' knowledge the only use of which is to attain pleasure and wonder. He criticizes the gathering of *rara* and *mirabilia*, which diverts philosophers from the explanation of phenomena through intellectual *praecognita*. De Raey refers for this to the *Novum Organum*[45], proposing his own interpretation of Bacon's words: he considers the distinction between *frugifera* and *lucifera experimenta* as between rare and common experiences (analogue to the general *praecognita*)[46]. In fact, De Raey criticizes a sort of natural philosophy that is not an explanation of facts according to intellectual models, nor a careful collection of phenomena as a

do, efficiat in corporibus nostris. […] Arte naturam perficere, vel superare laboravimus, quae prima mechanices artiumque, quas illiberales vocant, initia fuere» (*ibid.*, pp. 18-9).

[45] «Quem errorem graviter perstringit Verulamius Nov. org. aphorismo 119. cum inquit, *nos vero qui satis scimus nullum de rebus raris aut notabilibus iudicium fieri posse, multo minus res novas in lucem protrahi, absque vulgarium rerum causis et causarum causis rite examinatis et repertis, necessario ad res vulgarissimas in historiam nostram* (experimentorum nempe) *recipiendas compellimur. Quin etiam nil magis philosophiae offecisse deprehendimus, quam quod res, quae familiares sunt et frequenter occurrunt, contemplationem hominum non morentur et detineant, sed recipiantur obiter*» (*ibid.*, pp. 44-5). Cfr. Bacon, *Novum Organum*, 1, aph. 119.

[46] «Et postea aph. 121 ut et 70 experimenta prudenter distinguit in lucifera et frugifera, atque exemplo creationis, qua ante omnia alia facta est lux, lucifera experimenta, cuiusmodi vulgaria prae cateris esse solent, cum primarum causarum et verorum axiomatum inventione praemittenda esse monet, ne, si frugifera tantum quaerantur, vel initiis vel progressibus scientiarum remora aliqua iniiciatur. Perinde quidem atque Atalantae contigit, quae cursu certans cum Hippomene non alia de causa vincitur, quam quia, ad tollendum aureum pomum […] cursum aliquoties interrumpit […]. Adeo ut de praecognitis experientiae concludere liceat, ea […] lucifera esse debere, et vulgaria etiam ac valde communia raris et abstrusis utiliora plerumque esse ad naturae contemplationem» (De Raey, *Clavis philosophiae naturalis*, pp. 44-5). Cfr. Bacon, *Novum Organum*, 1, aphs. 70, 119, 121.

historia naturae – that he wants for the reformed arts[47] – but a childish interest for phenomena. Actually, Bacon also criticizes a too restricted form of experimental science: that of Gilbert, or of the alchemists. It can have some degree of usefulness, as De Raey himself admits[48]; however, it has to be reformed through a new program for scientific discoveries.

This reformation is to be pursued according to a Baconian program, while Descartes had to provide a new method for philosophy. In any case, De Raey is never clear on the status of empirical disciplines. He acknowledges a form of practical knowledge in Aristotelian philosophy: the recognition of powers in nature (no matter of their actual causes), and that sort of knowledge which gives us pleasure and wonder through *rara* and *mirabilia*. He stands, however, still in between these two forms of practical knowledge: the one more pragmatic, the other more striking[49]. Even if he embraces Baconian positions on the status of empirical disciplines, he is aware that Bacon's essentialist and qualitative method still implies an 'accidental' use of knowledge, what makes it closer to the contemplative Aristotelian physics.

3. *Bacon's heritage in the logic of ideas*

De Raey's criticisms of Aristotle, actually, find their proper place in logic, the discipline the Dutchman puts at the head of philosophy[50]. He assumes a threefold Baconian perspective on logic. It is conceived – in Baco-

[47] Cfr. *De Aristotele et aristotelicis*: «historia naturae, quia deficit in multis, imprimis perficienda et supplenda est, ea notando atque observando, quae utilia ad scientiam sunt. Cuiusmodi non rara tantum, et curiosa sunt, quibus multi delectantur, verum etiam obvia, communia et quae negligi, vel etiam contemni solent, quia non videntur utilia ad vitam esse» (De Raey, *Clavis philosophiae naturalis aristotelico-cartesiana. Editio secunda*, p. 219).

[48] «Rara quaedam et a communi sensu remota sensuum experimenta, quae vel a remotissimis terris peti, vel non nisi cum difficultate et labore aut etiam sumptibus vel arte parari solent, uti in chymicorum, medicorum, astronomorum aliorumque artificum observationibus evenit» (De Raey, *Clavis philosophiae naturalis*, pp. 43-4).

[49] Cfr. his commentary on the Torricelli's barometer: «ut naturae hoc arcanum tot nominibus admirandum longius prosequamur» (*ibid.*, pp. 196-7).

[50] Cfr. *supra*, note 39.

nian way – as a *medicina mentis*, a purgation of mind against anticipations and prejudices[51]. Moreover, it is through the misuse of logical categories that De Raey criticizes Aristotelian errors. According to him, Aristotle based his logic on a vulgar acquaintance of phenomena – the *intellectum sibi permissum*[52] – being just an interpreter of the common way of understanding[53]. Thus his logic has harmed all the developments in natural philosophy[54], because the Scholastics did not consider that Aristotle was speaking only about our ways to view the world[55]. These are the *modi sentiendi* and *considerandi*, the wrongly abstracted concepts like the categories and all the logical notions criticized in his *Specimen logicae interpetationis* (1669-71)[56]. Finally, De Raey's logical criticism of Aristotelianism has its focus

[51] Cfr. De Raey, *Clavis philosophiae naturalis aristotelico-cartesiana. Editio secunda*, p. 413.

[52] «Ideoque logicam invenere gentiles, quae ea tantum ratione uti docet quam habemus, *prout ex multa fide, et multo etiam casu, nec non ex puerilibus, quas primo hausimus, notionibus, farrago et congeries est*. Ut pulchre animadvertit Verulamius Novi Organi § XCVII, et hanc rationem passim *intellectum sibi permissum* vocat» (*Specimen logicae interpretationis*, in De Raey, *Cogitata*, p. 536). Cfr. Bacon, *Novum Organum*, *Praefatio* and 1, aphs. 2, 20-1, 97.

[53] De Raey, *Cogitata*, p. 558.

[54] «Nos veterem et vere aristotelicam probamus, novam quae vere talis non est reiicimus. Usque adeo, ut inutilem et noxiam putemus; sive usum spectes, quem videtur in aliis disciplinis habere, quasi hae sine ea intelligi non possint» (*ibid.*, p. 218). It has corrupted theology also: «sub […] scholasticorum dominatione primum philosophia ac dein etiam theologia ac medicina, cum plerisque aliis humanioribus scientiis, si non extinctae, misere saltem fatigatae ac oppressae aliquot seculis iecerunt» (De Raey, *Clavis philosophiae naturalis*, p. xvi).

[55] «Nos hic non intelligere eam philosophiam quae ab Aristotele nomen accepit et non tam rerum quam nominum et conceptuum est, quatenus composita fuit ad normam logicae sive dialecticae, quae circa nomina et conceptus versatur, ut non omnino male Verulamius observat in Novo organo sive instauratione scientiarum § 63. *Philosophiam naturalem dialectica sua corrupit quum mundum ex categoriis suis effecerit, animae humanae nobilissimae substantiae, genus ex vocibus secundae intentionis, tribuerit – magis ubique sollicitus, quomodo quis respondendo se explicet et aliquid reddatur in verbis positivum quam de interna rerum veritate*» (De Raey, *Cogitata*, p. 15). Cfr. Bacon, *Novum Organum*, 1, aph. 63; cfr. also 1, aphs. 11-6.

[56] In De Raey, *Cogitata*, pp. 535-96.

point on language and follows Bacon's considerations of the *idola fori*, its main points being the problem of confuse meanings and the names of non existing things[57].

De Raey focuses on the relevance of the ontology implied by language. This is something new in the sixteenth and seventeenth century philosophy. What has been called the first philosophy of language and ascribed to Locke[58] is to be previously found in De Raey and Bacon too. The main point of De Raey's *Cogitata de interpretatione* (1692) is the definition of standard terminologies for the different kinds of approach to reality. De Raey defines in this way what the Scholastics were actually speaking about. Above all, he criticizes the knowledge of names standing for that of things, or the *intellectus verborum* standing for the *intellectus rerum*[59]. The main error coming from this fallacy is the attribution of the features of names to things: in particular, the consideration of substantive nouns as names of substances, and adjectives as names of accidents, no matter of their actual subject[60]. This is the grammatical cause of the error of substantial forms. The criticism of Aristotle's logic is connected to that against the *idola fori*, for the use of erroneous concepts goes along with that of ambiguous names[61]. De Raey shows in detail how terms with a confuse meaning can have more and less appropriate use, admitting some degree in the legitimacy of their use, as the names of sensible impressions[62]. This, actually, follows Bacon's considerations on the degrees of error in the use of those words whose meaning is not clear and badly abstracted from

[57] Cfr. Bacon, *Novum Organum*, 1, aphs. 59-60.

[58] Cfr. P. Guyer, *Locke's Philosophy of Language*, in *The Cambridge Companion to Locke*, Cambridge 1994, pp. 115-45; M. Losonsky, *Language and Logic*, in *The Cambridge Companion to Early Modern Philosophy*, Cambridge 2006; Id., *Linguistic Turns in Modern Philosophy*, Cambridge 2006; *Language, Meaning and Mind in Locke's* Essay, in *The Cambridge Companion to Locke's* Essay concerning human understanding, Cambridge 2007.

[59] This criticism will be adopted by Heidanus in an even clearer Baconian context: cfr. *infra*, note 100.

[60] De Raey, *Cogitata*, pp. 218-22, 245-7, 581-3.

[61] As in the use of metaphysical concepts such as *esse*, *essentia*: which are just derivation from the verb *to be*, or the sign of our acts of affirmation: cfr. De Raey, *Cogitata*, pp. 149, 200. This position was embraced by Geulincx also: cfr. A. Geulincx, *Opera philosophica*, ed. J.P.N. Land, 3 voll., Hagae Comitum 1891-93, 1, p. 463.

[62] De Raey, *Cogitata*, pp. 81-2.

things[63]. The Baconian example offered to the Cartesians an effective aid in solving some problems. De Raey's attitude, however, is also critical toward the errors of Bacon himself: he is associated to Hobbes in the deprivation of meaning to those terms that do not stand for physical objects[64]. De Raey refers to Bacon's semantics of the first kind of *idola fori*, or the names of non existing things[65]. In fact, Bacon's theories are not used only as an authoritative source to support argumentations, but his philosophy is considered as influencing the current debates on language.

De Raey's 'Baconian' logic can be numbered among other examples of the logic of ideas[66] based on Cartesianism. As Bacon, he also tries to build a new *Organon*. More specifically, he considers those topics dealt with in *Categoriae* and *De interpretatione*, as other logicians faced the topics of reasoning and method. Among them we can count the pupil of De Raey at Leiden university, Clauberg, who adopted some Baconian positions in his *Logica vetus et nova* as in some other works, as I have noticed. *Logica* is one of the first logics embodying Cartesian principles, more focused on the *sermo internus* than on the formal structures of argumentation[67]. Actually, it does not share with the Port Royal *Logique* (1662) a systematic analysis of our ideas: however, it aims to the discovery of the truth, being more than a device to organize knowledges. Like De Raey's Baconian logic, it is conceived by Clauberg as a *medicina mentis*[68], by which he delineates a new course[69] in logical investigations: «futuro logico et philosopho errorum et imperfectionum humanae mentis in rebus cognoscendis ori-

[63] Cfr. Bacon, *Novum Organum*, 1, aph. 60.

[64] «Non sequitur, ut […] Verulamius putavit […] quod inania haec nomina sint, seu voces insignificantes, uti supra audivimus Hobbesium loquentem, atque suo hoc insigni errore abutentem ista Verulamii, et imprimis Cartesii observatione» (De Raey, *Cogitata*, p. 306).

[65] Cfr. Bacon, *Novum Organum*, 1, aph. 60.

[66] Cfr. P.A. Easton (ed.), *Logic and the Workings of the Mind: The Logic of Ideas and Faculty Psychology in Early Modern Philosophy*, Ridgeview 1997; P. Schuurman, *Ideas, Mental Faculties and Method: The Logic of Ideas of Descartes and Locke and Its Reception in the Dutch Republic, 1630-1750*, Leiden-Boston 2004.

[67] Cfr. book 4.

[68] «Morbi animi sunt errores, dubitatio, et reliquae […] imperfectiones, quibus ut medicina paretur, logica inventa fuit» (Clauberg, *Opera*, p. 770).

[69] «Novum hoc esse et insolitum in logicae vestibulum» (*ibid.*, p. 769).

ginem et causas investigandas esse»[70]. In the *Prolegomena* he merges some Cartesian notions, especially those on childhood and sense prejudices, presenting them as belonging to human nature, like the *idola tribus*[71]. He also emphasizes the role of education of the single men as the origin of the persistence of the childish prejudices[72]. In the main text of his *Logica*, moreover, he develops a criticism against the errors carried on by language[73].

It is interesting to notice how these criticisms (whose proper place is logic as the science of ideas, mental faculties and method)[74] are developed in other treatises as well, in particular in his *Defensio cartesiana* (1652), which insists on the importance of eradicating the *idola tribus*. He considers, for instance, the humidity of brain a source of error, according to a Heraclitean position inherited by Piccolomini and Bacon[75]. The problem of the bodily constitutions as something that can lead to different attitudes in science is a subtle problem within Cartesian philosophy. For science is conceived as a purely intellectual enterprise, the role of faculties as imagination or memory is neglected by Cartesian epistemology. Therefore, an attention on this topic manifests an influence from Bacon. His authority is not only used to criticize the negative influence of body on thought – in a plain Cartesian way – but also to discuss the conditions for a new system of sciences, as I have discussed above[76]. This is considered in *Corporis et animae coniunctio* (1664), where Clauberg quotes *Novum Organum* to show how different bodily temperaments bring to different dispositions

[70] *Ibid.*, p. 769.

[71] *Ibid.*, p. 770-6. At p. 872 we find the fundamental feature of the *idola tribus*: «fons errorum praecipuus ostenditur in eo, quod homines aliquid tale ac tantum concipiunt in rebus cogitatis atque alienis, quale et quantum quid est in ipsis cogitantibus, et rebus ad se pertinentibus».

[72] *Ibid.*, pp. 777-8.

[73] «Cur sermo humanus toties a rebus dissentit?» (*ibid.*, p. 868). Cfr. pp. 868-70.

[74] Cfr. Schuurman, *Ideas, Mental Faculties and Method*.

[75] Cfr. Clauberg, *Opera*, p. 1058; Savini, *L'insertion du cartésianisme en logique*, pp. 85-6. He also criticizes the errors of senses (ch. 32, theses 47-8) referring to *Clavis philosophiae naturalis*, 1, 2 in order to explain which are the kinds of sensation: cfr. Clauberg, *Opera*, p. 1055. Commenting this point he quotes the aphorisms 26 and 46 from the book 1 of *Novum Organum*, Clauberg, *Opera*, pp. 1063-4.

[76] Cfr. *supra*, note 36.

in scientific disciplines[77]. In fact, within the new science attention is paid not only to the habits of the pure mind, but also to an empirical attitude on mind-body relations. This attitude has still a Baconian root that is confirmed by Clauberg's quotations from *De augmentis scientiarum* to demonstrate the independence of soul from body[78].

4. *Some solution for physics, ethics and theology*

The Baconian – in some way, *novantiquus* – approach to the status of disciplines was not limited to arts or natural history. Among the problems raised by Cartesianism the epistemological justification of physics was one of the most important. In fact, the same scientific models were justified in different ways, as by De Raey's master at Utrecht university, Henricus Regius (1598-79), who developed an empirical approach in physics[79]. However, he did not openly adopt Baconian positions in his works, nor the Lord of Verulam was used as an authoritative source for quotations[80]. More than to Bacon, indeed, such philosophical background is to be traced back to the tradition of medical studies. A Baconian echo, however, is present in the works of Arnout Geulincx (1624-69), the Walloon Cartesian who lived and taught in Leiden. In his *Oratio dicta auspicio quaestionum quodlibeticarum* (1653, 1665) the order of sciences is argued as such: the first position is of mathematics, which does not rely on hypotheses. The second place is that of logic, or science of demonstrations, and metaphysics, the science of the essence and properties of soul and body.

[77] «Ingeniorum diversitas pendet a corporis humani, praesertim a cerebri et spirituum dispositione […]. Prae caeteris hic notanda est in aliis atque aliis hominibus alia atque alia indoles atque ad certum studii genus proclivitas. Unde ingenia metaphysica, mathematica, poëtica, musica, mechanica, militaria nuncupantur. *Maximum* vero *et velut radicale* (uti iudicat illustris Franciscus de Verulamio Nov. Org. lib. I aph. 55) *discrimen ingeniorum, quad philosophiam et scientias, illud est*» (Clauberg, *Opera*, p. 250); cfr. Bacon, *Novum Organum*, 1, aph. 55.

[78] Clauberg, *Opera*, p. 260, § 1. Cfr. Bacon, *De augmentis scientiarum*, 4, ch. 1.

[79] Cfr. Verbeek, *Descartes and the Dutch*, pp. 13-33, 52-77.

[80] There is a Baconian echo acknowledged by J.J.F.M. Bos, cfr. his *The Correspondence between Descartes and Henricus Regius*, Utrecht 2002, p. 12, note 3.

After it, natural history[81], by which it is possible to deduce provisional explanatory hypotheses belonging to physics, the fifth science: «intelligentia iam a scientiis culta, ab experimentiis firma ac matura, hypothesis physica proponatur, quae sensum cum ratione, experimenta cum scientiis ad amussim conciliet»[82]. Finally, ethics comes. Actually, in the 1653 Louvain edition the provisional character of physical hypotheses is even more stressed[83]. At that time, according to Aalderink, the influence of Bacon on Geulincx was more important than that of Descartes[84]. In fact, in Geulincx's case Baconianism seems to be the prelude for Cartesianism, and then a source of solutions for Cartesian problems as well.

Besides this Baconian echo in Geulincx's method for physics, we can find a similar influence also in his theory of error. In fact, the logics of Bacon, Clauberg and De Raey were meant to purge mind from error by going back to its deeper causes. Geulincx's logic had not such a purpose, being – in a traditional way – just the science of argumentation. However, as Aalderink points out[85], the criticisms carried on in his *Oratio dicta auspicio quaestionum quodlibeticarum* resemble those of the other Cartesians as well as Bacon's arguments. In the oration Geulincx distinguishes four tendencies, or *genii*, as the causes of error[86]. *Mango*, or the belief in a *harmonia mundi*. *Dogmatistes*, or the religious and philosophical dogmas deeply rooted in men. *Gerro*, or the love for dialectical struggles. *Pantomimus*, or the tendency to take metaphors for descriptions of reality, attributing, in this way, the features of the soul to bodies. This last tendency has in language a source of increasing power. As Bacon and De Raey, Geulincx also recognized in speech the main source of error, for it

[81] «Hanc voco congeriem ex diversis naturae phaenomenis experimentisque certis et indubitatis, pura narratione sine coniectura rationis, ob quam ita se habere videantur, propositis» (Geulincx, *Opera philosophica*, 1, p. 42).

[82] *Ibid.*, p. 43.

[83] «Hypothesis physica proponatur; id est, coniectura elementorum naturae, brevis sine superfluo, clara sine figmentis ignotarum rerum, quae experimentis omnibus continua deductione satisfaciat, scientiae, cuius vicem gerere debet, quam simillima. In hanc ne iuret discipulus; teneatur quoad phaenomenis omnibis respondeat; ubi in puncto deficit, reiiciantur, et alia tentetur verum» (*ibid.*, p. 43).

[84] Aalderink, *Philosophy, Scientific Knowledge, and Concept Formation*, p. 53.

[85] *Ibid.*, pp. 46-55.

[86] Cfr. Geulincx, *Opera philosophica*, 1, p. 45.

reflects a vulgar worldview. The main case is that of universal animation[87], which is criticized as a consequence of linguistic abuses by De Raey also[88]. According to Geulincx, the problem of language is especially relevant in ethics, the highest object of philosophy. In his *Ethica* (1665) he stresses the precision of language on things as an aid to pursue the virtue of justice, and the dangers hidden in their misinterpretation, the amphibology on terms[89]. Actually, the same attention on language that was paid by De Raey in physics (where language has to perfectly match primary qualities) is applied by Geulincx to ethics, according to their different interests.

As noticed, Bacon's philosophy is used to fill those gaps which Descartes left open. Therefore, his arguments were not confined to the resolution

[87] «Pantomimus est instinctus quidam atque proclivitas, metaphoram cum proprietate confundendi, seu ita capiendi, quod metaphorice dicitur, ac si id etiam in proprietate sermonis obtineret. Unde Pantomimi praecipua pars est proclivitas cogitandi, res omnes sensu nobis ac vita similes esse» (*ibid.*, p. 45). «Genius hic, iudices cum ad omnem metamorphosim inclinat propendetque, tum inanima in animata transformandi longe cupidissimus est. Ipse lapides, ipse silvas, montes, urbes, fluvios, ventos, et quaevis tandem adsciscit, in humanam societatem, et iubet homines nobiscum esse» (p. 14).

[88] It is the case of «actus», whose proper meaning, according to Varro, is «agitatus mentis». However, it is also applied to bodily motion. Cfr. De Raey, *Cogitata*, pp. 136-7. Cfr. also Varro, *ling.*, 6, 6.

[89] «Adminuculum iusttititae hoc erit: si serio apud animum nostrum perpendamus, res non esse quod esse passim dicuntur, si tantillum desit aut superet. Vulgus iactat et prodigit nomina, extenditque facile ad ea quibus non quadrant; quod fere est, esse dicunt: quod vix est, dicunt non esse. Et tolerandae forent haec vitia nominum, si non ea rebus ipsis adspergerent, et ex nominibus aestimare res ipsas assuescerent. Ii vero qui animum a vulgo ad philosophiam traduxerunt, facile capiunt, rerum essentias similes esse numeris, qui vel unius unitatis […] accessione vel detractione, illico naturam suam mutant, et in alios numeros degenerant» (Geulincx, *Opera philosophica*, 3, pp. 26-7). We can find a resemblance with De Raey's theory of the misinterpretation of words according to a *libido interpretandi*: «notio […] in his nominibus ad aliquid indefinite; et quae hinc orta sit perversa intepretatio, per libidinem praecipue» (De Raey, *Cogitata*, p. 230). Cfr. also p. 154: «amphibologia ista, quae in nomine amoris versatur, magnorum est in ethica causa errorum»; p. 277: «virtutis autem proprietates variae; et in diversis circumstantiis diversa munia, diversa nomina, vulgo multas virtutes fecerunt. Nihil equidem tam vulgum sapit, quam res ex nominibus aestimare; multas res esse putare, quotiescunque sonant multa nomina; multa dici putare, cum multis dicunt».

of problems concerning logic, physics or ethics, but they were adopted also in theology – in fact, *Cartesian* theology. Whereas theologians were mainly fighting philosophical incursions into their own field, some of them adopted Cartesianism. Among them, we find Abraham Heidanus (1597-1678). Although he adopted a Cartesian approach in theology, he used Baconian solutions for his problems. This was yet noticed at his own times, as Christoph Wittich (another Cartesian theologian), emphasized the relevant familiarity of Heidanus with Bacon and Descartes[90]. His case involves the Dutch religious struggles: his main target, indeed, is Socinianism, which the Remonstrants were commonly charged of[91]. After having discussed in the first book of his *De origine erroris* (1678) the original cause of error – Adam's sin – he turns on more particular causes[92], traced back to the four *idola*[93]. In fact, several lines of the second chapter are a paraphrase of *Novum Organum*[94]. He finds in Socinianism a consequen-

[90] «Heidanus noster […] lux aliqua ex Verulamii lectione, sibi illuxisset, in familiaritatem Renati des Cartes […] se insinuavit» (C. Wittich, *Oratio funebris in obitum Abrahami Heydani*, Lugduni Batavorum 1679). Cfr. Dibon, *Sur la réception de l'oeuvre de Bacon*, pp. 107-8.

[91] Cfr. M. Mulsow, J. Rohls (edd.), *Socinianism and Arminianism: Antitrinitarians, Calvinists, and Cultural Exchange in Seventeenth-Century Europe*, Leiden 2005.

[92] His approach is analogous to De Raey's, who in his *De origine erroris* compares the theological explanation of error with the philosophical one: Adam's fall, which from a gnoseological point of view is the triumph of the will, which is responsible of judgements on reality, and of the use of senses on that of intellect, or the attention on sensible upon intelligible things: «non contentus bonis iis quae possidebat, alia appetiit. Et sic abusus ea voluntate […] multum de primaeva naturae praestantia […] perdidit. […] Et ita quidem rationalis appetitus, sensitivo subiectus, et illius illecebris a summo et vero aversus bono, quod non tam sensu, quam intellectu percipitur; partim ad corporeas voluptates, partim ad ea quae secundum apparentiam potius, quam rei veritatem, bona sunt, paulatim magis magisque se convertit» (De Raey, *Cogitata*, pp. 447-8). The theory of will as the faculty responsible of error was adopted by Augustine and Descartes.

[93] «Utile ergo erit, impedimenta illa in certas classes dispescere, quo melius cognosci et caveri possint. In quo summi et incomparabili viri Francisci Baconis de Verulamio […] methodum quam ille in investigatione rerum naturalium observandam censuit, imitabimur; et ad errorum in religione causas venandas et detegendas traducemus» (A. Heidanus, *De origine erroris libri octo*, Amstelodami 1678, p. 66).

[94] *Ibid.*, p. 68.

ce of the *idola tribus*, or «intellectum […] facere mensura rerum»[95]. This brings also, actually, a criticism of the influence of senses in religious beliefs, which give rise to the catholic love for the external apparatus of religion[96]. Among the *idola specus*, moreover, he counts along with education also the human temperaments[97], largely referring to Hippocrates. As we have noticed, Clauberg finds in temperaments a condition of the differentiation of disciplines. The use of the traditional theory of humors and complexions within Cartesianism finds in Bacon its authoritative source. It was the case of De Raey also, who approved some use of Galen's medicine[98]. Bacon's approach was still seen as in between the ancient and the new empirical science.

A last point can reveal how deep was the reception of Bacon's philosophy in all the fields of Cartesianism. Discussing the causes of theological error, Heidanus develops from Bacon's arguments a broader critique towards Aristotelian method, regarded as the proceeding in science through badly abstracted logical concepts[99], which have their expression in an ambiguous language[100]. He finds in the Aristotelian deductive method the source of

[95] *Ibid.*, p. 72. On the *idola tribus*, cfr. ch. 1, §§ 7-8; on the *idola specus*, cfr. ch. 2. On the *idola theatri*, cfr. ch. 3, §§ 1-9. On the *idola fori*, cfr. § 10. Cfr. also his *Diatriba de Socinianismo*, printed as the appendix of *De origine erroris*: Heidanus considers the errors of language at ch. 2, § 4, and all the *idola* as causes of Socinianism at ch. 3, §§ 2-4. Cfr. also M. Aalderink, *Socianianisme als religie van de rede: De* Diatriba de Socinianismo *van de cartesiaanse theoloog Abraham Heidanus*, «Doopsgezinde Bijdragen», 30, 2004, pp. 53-71.

[96] «Et quia intellectus humanus, illis quae simul et subito mentem ferire et subire possunt, et quae in praecipuos sensus, visum et auditum incurrunt, maxime movetur et afficitur: ideo maxima pars vulgi religionem vestitam ceremoniis et ritibus externis, et ornamentis quae sensus feriant, eosque delectent, decoratam, praeferre solet cultui interno, quo Deus in spiritu et veritate in silentio colitur. Egregie hac arte praevaluit in mundo papismus» (Heidanus, *De origine erroris*, p. 75).

[97] *Ibid.*, b. 2, ch. 2, §§ 1-3.

[98] Cfr. De Raey, *Cogitata*, pp. 331-2; 333-6.

[99] Heidanus, *De origine erroris*, b. 2, ch. 1, § 4; ch. 3, § 8.

[100] «Tot nomina rerum confusae sunt significationis, et male terminata, et temere et inaequaliter a rebus abstracta, et, cum plures sint res quam voces, maximam partem aequivoca. […] Docet autem experientia, notitia rerum, etsi aliquatenus ex verbis comparari possit, et saepe debeat, si tamen praecedat intellectum verborum, magis distendere et implere mentem, quam nudum vocabulorum intellectum, imo magis facere ad melius

the corruption of theology and philosophy, «in theologia non minorum errorum haec methodus causa fuit»[101], or the use of deduction by too general concepts characterizing the *intellectus sibi permissum*, which do not match anything in reality[102]. His criticism is an echo of De Raey's analysis of the corruption of sciences caused by Aristotelianism: not only physics, but even theology and all the practical disciplines. According to the Cartesian paradigm the basis of scientific judgements are the innate ideas of the essences of things: namely, ideas of geometric features. Such ideas are general: however, this does not imply that they are *notiones secundae*, *modi considerandi*, or ideas of ideas. In this case, a recourse to induction as the attention to particular ideas, opposed to the too general ones, is a Baconian insertion adopted to prevent that theology – an intellectual science – becomes a mere consideration of thoughts. Bacon's theory on the inductive formation of particular concepts is used to criticize the recourse to excessively abstracted concepts and it is shifted on Descartes's rule of analysis:

> semper in conclusionibus, quae hoc pacto educuntur, plus sit quam fuit in praemissis. Quod contingit duabus ex causis: primo quod difficultates non bene resolvimus, nec in tot partes dividimus, quot expedit ad illas commodius resolvendas. Quod semper inductiones facit vitiosas. Deinde, quia non semper ordine procedimus, a rebus simplicissimis et cognitu facilibus ad difficiles et compositas[103].

intelligenda postea ipsa verba. Unde alicubi Lutherus: *grammatica quidem necessaria est et vera, sed ea non debet regere res, sed servire rebus*» (*ibid.*, p. 95). Cfr. M. Luther, *Werke*, 42, Weimar 1911, p. 599.

[101] Heidanus, *De origine erroris*, p. 68.

[102] «Gestit enim mens exilire ad magis generalia, ut acquiescat; et post parvam moram fastidit particularia. Unde fit, ut quae sibi fabricavit universalia, tanquam praecepta quaedam et canones, ex quibus inferat pareticularia, semper fere reperiantur male abstracta et insufficentia ad inveniendam veritatem. […] Cum e contra ad veritatem inveniendam initium semper a notionibus particularis fieri debeat, ut postea ad universale accedatur: quamvis etiam reciproce, universalibus inventis, et rite deductis et abstractis, aliae particulares inde deduci queant. […] Haec via procedendi ab universalibus ad particularia, multum incommodavit scientiis», *ibid.* «In dialectica illa, quae vulgo in scholis regnat […] non enim illa res aut artes et scientias ipsas invenire docet, sed tantum argumenta et notiones secundas, quibus res inventas vestire» (*ibid.*, p. 92). This thesis is the same as that of De Raey's *Specimen logicae interpretationis*.

[103] Heidanus, *De origine erroris*, pp. 74-5.

This use of Bacon's advices against the misuse of general concepts is not contradicting Heidanus's Cartesian epistemology, as experience is conceived as *magistra stultorum*[104]. In any case, from his approach we learn that even in theology there was space for Baconianism as the second line theory in early modern philosophy, adopted whenever Descartes's teachings could not be used. Somehow, Heidanus was partially following De Raey's advice on a non-Cartesian reform of practical disciplines, including theology. Indeed, theology is a practical discipline, aimed to man's salvation. Therefore, it had not to be based on the theoretical Cartesian models but on Revelation.

5. *The irrelevance of Bacon for the Newtonians*

Whereas the recourse to experience was supported by the authority of Bacon during all the seventeenth century, with the rise of a more advanced empirical philosophy his message seemed to lose its fascinating power. As Bacon's thought provided several solutions in the Cartesian context by answering to its problems (above all, that of the role of *historia*), it radically lowered among the Dutch Newtonians Willem Jacob 's Gravesande (1688-1742) and Pieter van Musschenbroek (1692-1761). The reason for this is that the essentialist and qualitative Baconian physics could give more answers to the problems evoked by Cartesianism than those of Newtonianism. Newtonians had no interest in the use of imaginative hypotheses on the constitutions of bodies, and were more concerned with a systematical application of mathematics to natural laws. On the contrary, the Cartesian approach shared with Baconianism the quest for essences (even if in mechanical terms) and a limited use of mathematics. The only *trait d'union* between Bacon's and Dutch Newtonian philosophy is the vulgarization – relieved by Giambattista Gori in his analysis of the didactic function of the works of 's Gravesande[105] – of Newton's highly mathematized physics by underlining its experimental aspects, as it can be noticed in 's Gravesande's illustrated manuals[106]. The fall of

[104] Cfr. *ibid.*, p. 86: «alii ergo experientia, stultorum magistra edocti, intellectum sibi permissum esse nimis vagum, et merito suspectum, de remediis cogitare coeperunt».

[105] G. Gori, *La fondazione dell'esperienza in 's Gravesande*, Firenze 1972, pp. 94-7.

[106] W.J. 's Gravesande, *Physices elementa mathematica, experimentis confirmata. Sive*

Baconianism in a Newtonian context reveals that Bacon's fortunes went along with Descartes's. In some manner, the establishment of Newtonian philosophy embodied the Baconian project of a comprehensive, experimental philosophy: however, the very contents of Bacon's philosophy were no more useful for Dutch Cartesians.

Newtonian physics knew a wide spread in the Dutch Republic, starting from the university of Leiden. Its rise was however prepared by those who adopted experiments in the teaching of physics. As Burchard De Volder (1643-1709) and his colleague Wolferd Senguerd (1646-1724), who were still under some Baconian influence. Moreover, during all the seventeenth century some form of Baconian experimentalism was provided by other philosophers and naturalists[107]. Among them, Jan van Brosterhuysen, who commented some experiment of *Sylva sylvarum*[108]; Isaac Beeckman, who criticised the mathematical errors of Bacon and wrote a brief compendium of *Novum Organum*[109]. Furthermore, Henricus Reneri[110] adopted a Baconian approach in his *Disputationes physicae* (1635)[111] and Christiaan Huygens proposed a Baconian program to the *Académie des sciences*[112] in 1666.

introductio ad philosophiam newtonianam, Lugduni Batavorum 1720-21; Id., *Philosophiae newtonianae institutiones, in usus academicos*, Lugduni Batavorum 1723.

[107] Cfr. *supra*, note 4.

[108] Cfr. his correspondence with Constantijn Huygens: C. Huygens, *Briefwisseling*, 1, ed. J.A. Worp, Den Haag 1911, pp. 251, 253-4, 257; Id., *Briefwisseling*, 3, Den Haag 1914, pp. 209-10. Cfr. Dibon, *Sur la réception de l'oeuvre de Bacon*, pp. 98-9.

[109] I. Beeckman, *Journal*, 2, ed. C. De Waard, Den Haag 1942, pp. 153, 251-2, 254-5, 276, 327-8, 330; Id., *Journal*, 3, Den Haag 1945, pp. 51-5. Cfr. Dibon, *Sur la réception de l'oeuvre de Bacon*, pp. 92-7.

[110] Maybe the first Cartesian scholar in the Dutch universities: cfr. F. Sassen, *Henricus Renerius, de eerste 'Cartesiaanse' hoogleraar te Utrecht*, Amsterdam 1941.

[111] H. Reneri, *Disputationum Physicarum prima … quinta*, Traiecti ad Rhenum 1635. Cfr. *Disputatio prima de natura et constitutione physicae*, theses 10-2, 15-6. Cfr. also his letter to David de Wilhem of 26th of February 1638, ms., Universiteit Bibliotheek Leiden, BPL 29 A. It is reported in Dibon, *Sur la réception de l'oeuvre de Bacon*, pp. 112-3. Cfr. also pp. 103-11.

[112] C. Huygens, *Oeuvres complètes*, 6, ed. J. Bosscha, Den Haag 1895, p. 95. Remarkably, his father Constantijn firstly introduced Bacon's philosophy in the Dutch Republic, cfr. Huygens, *Briefwisseling*, 1, p. 69. Cfr. Elena, *Baconianism in the Seventeenth-Century*

Leiden University, in fact, had yet a longstanding empirical tradition, which can be traced back to the iatrochemist Franz de le Boë[113], but Senguerd and De Volder were those who established the Leiden experimental cabinet. The Aristotelian Senguerd wanted to integrate the powers of intellect with those of experience[114], according to an eclectic approach influenced by the empiricists. On the other side the Cartesian physician De Volder was still open to the problems of Cartesianism in empirical disciplines. He was deeply convinced on the intellective foundation of natural philosophy[115]. However, he was also admitting the role of experience as an alternative source of knowledge in physics, like in the acknowledgement of the existence of the objects of ideas[116]. Both were interested in the use of experiments: however, mainly for teaching duties. Even if De Volder was under the influence of the Royal Society[117], their experiments had nothing to do with the empirical philosophy provided by the Newtonians. They were still interested in the discovery of the causes of phenomena trying to find out their essences more than by providing predictions. In this, they have a Baconian influence attested, for instance, by Senguerd's writings[118]. The case of De Volder recalls De Raey's Baconian approach as he develops

Netherlands, pp. 36-8; Dibon, *Sur la réception de l'oeuvre de Bacon*, pp. 91-2. Cfr. also J.A. Worp, *Fragment eener autobiographie van Constantijn Huygens*, «Bijdragen en Mededeelingen der Historisch Genootschap», 18, 1897, pp. 1-122: 115; R.L. Colie, «*Some thankfulness to Constantine*»: *A Study of English Influence Upon the Early Works of Constantijn Huygens*, The Hague 1956.

[113] On the gradual introduction of empiricism in Leiden, provided also by supporters of iatromechanics as Florentius Schuyl, Theodor Craanen and Archibald Pitcairne cfr. H. Krop, *Medicine and Philosophy in Leiden around 1700: Continuity or Rupture?*, in *The Early Enlightenment in the Dutch Republic, 1650-1750*, Leiden 2003, pp. 173-96.

[114] Cfr. W. Senguerd, *Inquisitiones experimentales*, Lugduni Batavorum 1690, pp. 6-7. Cfr. Ruestow, *Physics at Seventeenth and Eighteenth-Century Leiden*, pp. 91-112.

[115] B. De Volder, *Exercitationes academicae, quibus Renati Cartesii philosophia defenditur adversus Petri Danielis Huetii episcopi Suessionensis censuram philosophiae Cartesianae*, Amstelodami, Ravestein 1695, p. 48.

[116] B. De Volder, *Disputationes philosophicae de rerum naturalium principiis*, Lugduni Batavorum 1681, pp. 19-20; *Quaestiones academicae de aëris gravitate*, Middelburg 1681, opening letter, pp. i-ii.

[117] Cfr. J. Le Clerc (ed.), *Biblioteque choisie*, 18, Amsterdam 1709, p. 362.

[118] Cfr. Senguerd, *Inquisitiones experimentales*, pp. 10-1.

a natural history useful for medicine[119]. Musschenbroek himself, indeed, associates him with Bacon in his *Oratio de methodo instituendi experimenta physica* (1730)[120].

Moreover, the practical value of their experiments seems also to rely on the prestige they could give to the academic institution[121]: Senguerd and De Volder were not too far from De Raey's emphasis on experience as a mean to excite wonder. In fact, only with the introduction of a mathematized empirical science it would be possible to realize the dream of a dominance of nature. This could be provided nor by Bacon's inductive essentialism, nor by Descartes's intellectualism. Therefore, in the eighteenth century the number of the editions of Bacon's works drastically lowered in the Netherlands[122], with the exception of two works concerning him: Alexander De Leyre's *Analyse de la philosophie du chancelier François Bacon* and the French translation of David Mallet's *The Life of Francis Bacon, Lord Chancellor of England*[123]. These books, however, seem to testify more the interest for Bacon in the French than in the Dutch context, as they can be linked with the coeval debate of the *Philosophes* on the order of sciences[124].

We still can find a Baconian echo in 's Gravesande's *Introductio ad philosophiam, metaphysicam et logicam* (1736), devoting a chapter to the cau-

[119] B. De Volder, *Oratio de rationis viribus*, Lugduni Batavorum 1698, p. 27.

[120] «Eiusmodi scientiam condiderunt, qui sese eclecticos professi sunt, qui […] omnia vera et falsa inter se imprudenter miscuerunt […]: atro hos olim carbone Verulamius notandos censuit, […] imo fidus illud leydensis lycaei clarum Volderus: quondam hanc methodum, ut pessimam, ex philosophia multis gravissimisque aliis argumentis proscripsit» (P. van Musschenbroek, *Tentamina experimentorum naturalium captorum in Academia del Cimento*, Lugduni Batavorum 1731, p. ix). The book is a Latin translation, enlarged with several commentaries and new texts, of Lorenzo Magalotti's *Saggi di naturali esperienze*, Firenze 1667.

[121] Cfr. Ruestow, *Physics at Seventeenth and Eighteenth-Century Leiden*, p. 101.

[122] F. Bacon, *Opera omnia, novae huic editioni accedunt opuscula historico-politica ex anglico nuper Latine*, Amstelodami 1730; Id., *Fragments extraits des oeuvres du chancelier Bacon*, Amsterdam 1765.

[123] D. Mallet, *Histoire de la vie et des ouvrages de Francois Bacon, grand chancellier d'Angleterre*, Leyde 1742[1]; Amsterdam 1755[2]; A. De Leyre, *Analyse de la philosophie du chancelier François Bacon*, Amsterdam 1755; A. de Leyre, D. Mallet, *Analyse de la philosophie du chancelier François Bacon. Avec sa vie*, Leyde 1756, 1778[2].

[124] Cfr. *supra*, note 1.

ses of error[125] which has however little to do with Bacon's proper theory of *idola*[126]. On the other side, Hermann Boerhaave (1668-1738) paid more attention to the Lord of Verulam in his *Oratio de comparando certo in physicis* (1715)[127], associating Bacon with Descartes in his criticism against Aristotle. Their systems, however, were later superseded by empirical philosophy:

inde castigatorem perpetuum Aristotelem habuit, quem sua substituentem, post longa principatus in physicis gestis tempora, chemici, Verulamius, et Cartesius deformatum subito, atque insignibus spoliatum ornamentis, regno diu usurpato deiecerunt. Neque interim chemicorum, neque cartesianorum, longa dominatio: horum quippe compressus valde impetus simul ut, felici physicis fato, excussa eorum sententia fuit per illos, qui sola fida experimenta pro ponendis, severissimasque geometriae leges pro norma ratiocinandi, in physicis admiserunt[128].

Some praising of Bacon is present in Musschenbroek's works also, as in *Physicae experimentales dissertationes*[129] and in the above mentioned *Oratio de methodo instituendi experimenta physica*, regarding Bacon along

[125] W.J. 's Gravesande, *Introductio ad philosophiam, metaphysicam et logicam*, Lugduni Batavorum 1736, pp. 223-57.

[126] «Capita autem ad quae errores referam, sequentia sunt, 1. Auctoritas. 2. Corporis consitutio. Ubi de animi affectibus agendum erit. 3. Superbia. 4. Pigritia, aut ignavia. 5. Confusio idearum. 6. Necessitas eligendi inter opiniones. 7. His addam explicationem errorum, in ipsis ratiociniis, qui a dialecticis ad peculiaria capita fuere relati» (*ibid.*, p. 226).

[127] H. Boerhaave, *Opuscula omnia*, Den Haag 1808, pp. 27-36.

[128] *Ibid.*, p. 34. He also prizes Bacon as the founder of modern natural history: «atque huius quidem physices fortunas laudare licet ex quo magnum Verulamium summo suo bono accepit! Virum certe ad omnia, quae scientia humana comprehendi possunt, indaganda facile principem, et de quo dubites utrum consilio, an exemplo, labore, vel liberalitate, maior fuerit in instauranda deformata physica. Absque invidia dixero, quidquid incrementi cepit naturali historia ab ineunte decimo sexto seculo in hanc usque horam, omne id acceptum debemus monitis, praeceptis, et experimentis illius viri, cuius indelebilem memoriam grata colet orbis perpetuitas» (p. 35).

[129] «Quibus elapso seculo perspectis immensum pondus nugarum ex philosophia eliminarunt Verulamius, Helmontius, Galilaeus, Torricellius, Mariottus, Redus, Boyleus, Newtonus» (P. van Musschenbroek, *Physicae experimentales dissertationes*, Lugduni Batavorum 1729, *Praefatio*, p. ii).

with Boyle and Newton among the founders of experimental philosophy[130], and as the discoverer of a new way to physics[131]. However, his name is easily forgotten, few lines later, when Musschenbroek praises those who proficiently applied mathematics to physics:

quantum praesidii, quantum emolumenti physica matheseos auxilio non accepit! Id suis luculenter docuerunt inventis Galileus, Torricelius, Mersennus, Hugenius, Newtonus, 's Gravesandius, aliique, naturae arcana, mortalibus vix speranda, revelantes[132].

In fact, Musschenbroek adopted a 'Baconian' approach in experimental philosophy as he collected an impressive amount of experimental data to allow further enquiries by the scientific community. This is revealed by the large amount of data graphs present in his works, as those provided for the sake of the discovery of a law of magnetism in *Dissertatio physica experimentalis de magnete*[133]. This, actually, explains his propagandistic use of the name of Bacon, whose philosophy, however, was no more a fruitful source of arguments. Musschenbroek's quantitative collections can not be compared, in fact, with Bacon's *tabulae*, whereas the two have in common, broadly, only an inductive (and cooperative) approach to science.

Even Christian Huygens, who defended Bacon's philosophy in his correspondence with Leibniz[134], in his later years criticized his lack of mathematical approach, «Verulamius a vu de mesme l'insuffisance de cette philosophie Peripateticienne […]. Mais au reste il n'etendoit point les math-

[130] «Elapso ut et hoc seculo, quo philosophiae peripateticae iugum excussum est, heroes nostrae scientiae hoc luculenter viderunt; idcirco Verulamius, Boyleus, et Newtonus in Britannia […] philosophiam experimentalem condiderunt» (van Musschenbroek, *Tentamina experimentorum naturalium*, p. viii).

[131] «A mundo condito usque ad tempora Verulamii et Galilei actum fuit in physica fere nihil» (*ibid.*, p. xliii). In the *Preafatio* to the volume a further reference to Bacon and Galileo is present: «media in eiusmodi barbarie eluxit in Britannia Baco de Verulamio, in Italia Galileus» (pp. i-ii).

[132] *Ibid.*, p. xliv.

[133] van Musschenbroek, *Physicae experimentales dissertationes*, pp. 1-274.

[134] C. Huygens, *Oeuvres complètes*, 10, Den Haag 1905, p. 239. Cfr. Elena, *Baconianism in the Seventeenth-Century Netherlands*, pp. 38-9.

ematiques et manquoit de penetration pour le choses de physique»[135]. In fact, in the eighteenth century Dutch context the name of Bacon survives only in the 'histories of experimental philosophy', his name being linked to that of Boyle by Adriaan Reeland and Hermann Wits[136]. Since a systematical view of philosophy was losing its appeal and the Aristotelians were no more the enemies of new philosophy, even the Baconian approach on error was abandoned. In fact, only with the rise of Diderot's and d'Alemberts encyclopaedic view the Baconian dream of an empirical and practical knowledge will be recalled by European philosophers.

[135] Huygens, *Oeuvres complètes*, 10, p. 404.

[136] Cfr. F. Sassen, *Geschiedenis van de wijsbegeerte in Nederland tot het einde der negentiende eeuw*, Amsterdam-Brussel 1959, p. 178; Thijssen-Schoute, *Nederlands Cartesianisme*, p. 526. Cfr. Dibon, *Sur la réception de l'oeuvre de Bacon*, pp. 114-5.