

Reflections on the Baroque in the history of science

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**Gunnar Eriksson, *The Atlantic Vision.*
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Jens Høyrup

Categories like “Renaissance science” and “science of the Enlightenment” are well established, and founded on arguments that the spirit of the scientific activities in question are indeed akin to – or even essential to – the Renaissance and Enlightenment movements at large. Were it not for our inveterate blindness to the all-too-habitual, it might therefore astonish that so few historians of seventeenth-century science refer to the baroque or ask whether a category of “baroque science” be meaningful.

The rare references to the baroque that occurred until recently turn out to confirm rather than to be exceptions from this absence of the baroque as a mental category from the historiography of science. Thus Reijer Hooykaas [1972: 161] speaks of modern science as a product of the “scientists of the Renaissance and Baroque periods,” while J. E. Hofmann [1953: I–II] distinguishes “Übergang zum Barock (1450–1580)” (I, p. 100), “Frühbarock (etwa 1550 bis 1650 n. Chr.)” (I, p. 116), “Hochbarock (etwa 1625 bis 1665)” (II, p. 4) and “Spätbarock (etwa 1665 bis 1730).” For both, the baroque is defined by mere chronology, and none of them gives any argument that the “baroque” of the scientific workers be related to the core of the baroque current as it manifests itself in architecture, sculpture, painting and poetry.

A similar chronological approach is of course familiar from the history of music, where every composer between Monteverdi and Bach is automatically classified as baroque. As the baroque became fashionable in the wake of Wölfflin’s *Renaissance und Barock* (1888), there was also a tendency to find the baroque in all seventeenth-century literature (but at least to *find* it). To this, René Wellek [1968: 195a] objects that

The term baroque seems [...] most acceptable if we have in mind a general European movement whose conventions and literary style can be fixed narrowly, as from the last decades of the sixteenth century to the middle of the eighteenth century in a few countries.

Gunnar Eriksson, in his book on “Olaus Rudbeck and baroque science,” does not go as far as this; his starting point is “a denomination of the age common to all branches of culture, not only those of art and fiction: the baroque period” (p. viii). But by choosing Olaus Rudbeck as his protagonist (and choosing among the works of Rudbeck the *Atlantica* as the main focus) he clearly aims at finding a type of scientific work that shares the character-

istics of indubitably baroque art – say, Góngora or Calderón rather than Racine.

We shall return to the general problems implied by the attempt to characterize early modern science as a whole as baroque, and by the use of a fringe figure (however interesting, as we shall see) as the model or prototype. At first, however, the description and analysis of Rudbeck deserves our attention.

Around the age of 20, Olaus Rudbeck (1630–1702) discovered the lymphatic system independently of Thomas Bartholin – “the first, and for long the only, important discovery of a Swedish scientist” (p. 1 – happily bygone are the days of patriotic historiography of science). After studies in Leyden, he received a chair in medicine at the University of Uppsala in 1660. He was active in university administration, had mechanical manufactures installed and taught technology to interested students, probably inspired by the Leyden professor Franz van Schooten. He considered it the task of the university to train the whole social elite, “secular or spiritual, civil or military, indeed, all kinds of services, as master masons, carpenters, builders of mills and fountains, hammersmiths, etc.” (p. 11, Eriksson’s translation of Rudbeck). His ideas were thus Baconian, although Eriksson has only found a single (unpublished) reference to Lord Verulam in Rudbeck’s writings. He tended toward Copernican views (one of the earliest Swedish scholars to do so), and took the modern side (and quite effectively so) in the conflict between neo-Aristotelians and Cartesians at Uppsala University, without accepting the strict Cartesian orthodoxy – in anatomy, his starting-point was Harvey. He was also a botanist, and planned to publish an atlas of all known plants of the world; almost 1200 woodcuts were printed, c. 5,800 other woodforms were destroyed in the great fire of Uppsala in 1702.

However, Rudbeck’s fame – or notoriety – is mainly due to his historical and antiquarian work, the *Atlantica*, of which three completed volumes (1679, 1689, 1698/99) and one unfinished (1702) were published, some 3000 folio pages in Swedish together with a Latin translation.¹ The work is

¹ Eriksson gives 2000 pages for the twentieth-century edition of the Swedish text alone which he has used, and appears not to have seen the original edition (on p. 13 he states that the Latin text is on the verso pages and the Swedish on the recto;

described by Eriksson (p. 3) as

a voluminous and ill-fated account of the history of Sweden [...], where [Rudbeck] proudly expounded its main thesis: that Sweden was one of the first countries inhabited after the Flood, that Sweden must be identified with the Atlantis of Plato, and its inhabitants with the Hyperboreans of many classical authors, as well as with the Scythians, the Trojans, the Goths, all leading up to the conclusion that Sweden or Fennoscandia was the cradle of many peoples who after vast migrations had shaped world history, and was as well the place of fundamental achievements: the invention of astronomy, time reckoning, and writing.

As pointed out by Eriksson, the work is in the patriotic tradition inaugurated by Goropius Becanus (*Origines Antwerpianae*, 1569), and like its precursors it is partly constructed upon that kind of etymology in which, as Voltaire is supposed to have said, “the vowels count for nothing and the consonants for very little.” But Rudbeck’s method is not restricted to etymology and philology, and even when etymologizing it is in principle much sounder than the hilarious etymologies of a Goropius Becanus (cf. the description in [Metcalf 1974: 243]) and his kind, of which he actually makes fun ([Rudbeck 1679: 17], my translation): after having pointed at the complete lack of relationship between Swedish FOLK and Latin *gens* he presents Cluverius’s etymological “method” (according to which *Theut* becomes *Dan* and *Dan* becomes *Godh*), ending by the remark that

I wonder why he does not substitute even more [...]. And if one is allowed to make such substitutions, then all languages can be made into one and one into all. Thus, substituting F with G, O with E, L with N, and K with S. Then from FOLK you obtain the word *gens*.

Rudbeck’s own etymological method is empirically founded – the interchangeability of *F* and *B* for instance argued (p. 19) from the correspondence between Swedish *skriFwa* and Latin *scriBere*, and between Swedish *liuFlig* and German *liBlig* (etc.). He is at best only vaguely aware that such correspondences belong to specific pairs of languages² and to

actually the two are found in parallel columns). 3000 pages for the total original edition is a minimal estimate, made from comparison of its first volume (the only volume I had access to) with the paginations of the modern edition.

² An example picked more or less at random: On p. 714, *Minotaurus* becomes

specific phonological contexts – the Grimm brothers were far in the future – but his examples are mostly chosen with delicate intuition and the empirical intent unmistakable.³ None the less he appears to be fully conscious that the abundance of correspondences – (B≈P≈F≈W) (C≈K≈Q≈G) (J≈G) (D≈T) (L≈R) (M≈N) etc. – allows to achieve almost any result one may wish; vol. I at least ends with the following image (trans. Eriksson, pp. 44f):

This building [viz. the *Atlantica*] has three parts, the foundation, the walls and the roof, with its ornaments and decorations. Ornaments and paintings do not please all in like measure, for as one person [wants green the other wants grey, when the one]⁴ likes Doric the other likes Ionic. With this I mean the style and the origin of words, for maybe one is more pleased if Neptune has his origin from bathe or depict rather than from ruling the sea, and Hercules rather from being the Honour of Juno (the weather) or etc., than from being a warrior chief.

The walls and the roof are what I call the writings of the ancients with which the building is put together. If they do not tell the truth, neither could I. For I did not live in the time of Troy or before.

The foundation is what I call the country of Sweden, its lakes, mountains and streams and other such things [through which the ancients have described Sweden's certain position], all of which features remain undisturbed until the stone, mentioned by Daniel, who himself planted it, falls from heaven crushing everything.

While sixteenth-century etymology was considered to convey the same kind of hidden truth as the cabala, Rudbeck thus agreed with the baroque theoreticians of his own times – Stigliani, Kircher, Caramuel (see [Koch 1983], and below) – in regarding his etymologies as poetic similes or emblemata that surely convey a message but are neither necessary historical

Mannathyr or *Mannathor*, “since with us *au* becomes *o*.”

³ Eriksson deliberately concentrates on Rudbeck's *natural* science, and therefore omits closer characterization of his philology and linguistics. Even in the natural domain, however, he finds the same empiricist orientation combined with an immoderate belief in the generalizability of the observations – for instance when Rudbeck uses the thickness of the layer of dirt left by the snow over one winter in a vessel in his garden as a general measure of the yearly growth of the layer of humus (p. 15f).

⁴ This and the following bracketed passage, found in the original edition [Rudbeck 1679: 887], are omitted by Eriksson, or perhaps by the edition of the Swedish text which he uses.

truth about the origin of words nor devoid of arbitrariness⁵ (at least in principle, at times Rudbeck's walls seem to be actually held together by nothing beyond the decorations – cf. Eriksson, p. 135). He is also aware that the ancient written sources which he uses will often be based on oral traditions and thus be no more reliable than such traditions themselves – going so far as applying this principle to Moses' supposed writing of *Genesis*, though with some circumspection: “what he tells about what happened before the Flood, and for some time after it, he must necessarily have received from SÄGN [oral accounts], although it was told him by God Almighty himself” ([Rudbeck 1679: 2], my translation). Granted the assumptions that the ancient myths and poems are derived from real history and geography, and that their gods and heroes are historical persons in disguise, there is thus, in the perspective of the later seventeenth century and its new science, no reason to reproach Rudbeck for making *Realphilologie*, trying to find the regions of the world which best fit the descriptions – in particular since he tries to give empirical evidence when correcting the written sources, showing for instance that geography based on oral reports from travellers is likely to give results deviating as much from measured truth as Ptolemy's geography deviates from the claims of the *Atlantica*.

In spite of such seemingly solid principles and sane efforts at empirical control, the outcome of course ran wild; when, for instance, Apuleius tells in the *Metamorphoses* that he “came to the confines of death” during his mystical initiation to Isis, seeing there “the Sun in the middle of the night,” Rudbeck takes this as proof that he has travelled to the realm of the

⁵ The emblematic character of the etymologies is underscored by the multiple interpretation of a single etymon – thus the derivation of Mercury “from old Swedish *merkia* (to mark),” which firstly tells that the god masters “all kinds of marks, such as the letters, the banner of the army, the marks on iron and other products when offered for sale, but also [...] the dates of the *markets*, and last but not least, that he was a truly *remarkable* man” (Eriksson, p. 34) – and indeed much more, the analysis runs over more than seven folio pages in the original edition. Such mirroring and multiplication of meanings is wholly in line with Caramuel's characterization [1663a, *Apollo logogrificus* p. 215] of the logogriff as an “enigmatic song, which digs many significations from the same name, reading backwards, taking away letters or adding others.”

midnight sun, dismissing that part of the account which shows that everything took place within the Isis temple, and concludes that “Apuleius [...] tells that he himself has been at the extreme ends of the Earth, and indicates some particular circumstances and indications about the pagan rites of our fathers, which others do not mention if I remember well” ([Rudbeck 1679: 569], my translation). Accordingly, Eriksson prophesies in the preface (pp. viif) that “the reader will find most of Rudbeck’s arguments ridiculous and his whole book verging on madness,” adding however the wish that it will also appear “full of poetic imagination and dreamlike metamorphoses of identification as full of surprises as the imagery of *Finnegans Wake*.” The reviewer agrees to the full – more so as regards “poetic imagination” than “madness.” Eriksson’s book makes Rudbeck stand out both as a remarkable participant in the scientific movement of the later seventeenth century and as a sympathetic scholar. If Cusanus is worth discussing in the context of fifteenth-century mathematics – and he is, with his squarings of the circle and his numerological proof that God has to be ternary and could not possibly be quaternary – then Rudbeck belongs to the history of early Modern science, not least on account of his *Atlantica*.

Interesting though it is, the portrait of Rudbeck is mainly a means to an end, namely to trace the characteristics of “baroque science” in general, under the assumption (pp. 156f) that

Concepts such as “renaissance scientist,” “baroque scientist” and “classical scientist” must be regarded as ideal types (*sensu* Max Weber). They are fictions and extremes, used for comparison with real personalities or occurrences, and in the real world, they can be found only in varying degrees, often intermixed. An inventory of baroque scientists therefore would present a mixed assortment of characters, each of whom would be worth a lengthy discussion about his proper legitimation in this respect. If Kircher is close to being a prototype of a “baroque scientist,” but alas was no Copernican, Kepler is perhaps too much of a renaissance Platonist and mystic to fit the type, while Galileo, on the other hand, may, in his almost timeless scientific lucidity, be seen more as a classicist.

Even though it is not stated explicitly, the concepts of “ideal type” and “prototype” (a real-world example coming close to the ideal type, itself an abstraction) are obviously the reason for basing the investigation on a peripheral figure like Rudbeck, and not on central actors like Boyle,

Oldenburg or Huygens.⁶ It is asserted (p. 157) that Boyle and Huygens “seem to share properties typical of the baroque scientist,” but no arguments at all are given as far as Boyle is concerned, while those pertaining to Huygens (pp. 161f) are few and slight. It is true that our present-day delimitation of the group of “central actors” is *not* just a whiggish projection of eighteenth- to twentieth-century appraisals onto the seventeenth century – *vide* the roles of the three persons in the Royal Society and the Académie des sciences; but what made them more central than Rudbeck and Kircher precisely for what was understood in their own times as natural philosophy or (French) *science* was their stricter binding to long-lived norms and aims for the study of nature that would only to some extent bend to the pressure of a baroque (or other) *Zeitgeist*. Hence, the best representatives of scientific activity marked by this *Zeitgeist* (the best “prototypes”) need not belong to the group of “central actors.” (See however below).

Little is said by Eriksson about the general characteristics of the baroque *outside* science. In an offhand remark (p. 95) we are told that “the baroque was an age of overstatement.” Pp. 121f present Rudbeck’s understanding of “myths and rites, plays and popular customs” as “riddles,” appearing like a genuine riddle

to be about one thing but in fact to be or describe something else, often unconsciously because the original design of the riddle had been forgotten or distorted (e.g., by migration from the region of its proper context), but no seldom consciously in the sense that the riddle, play, rite or myth deliberately both disguised reality and invited its unmasking.

In this connection, Eriksson points (p. 124) to “the role emblematics played in baroque culture,” an emblem being “a picture, often of mythological character, combined with a short poem that made the meaning of the picture clear. The picture was often enigmatic, indeed, making the written

⁶ A reason to choose Rudbeck instead of a similar figure like Kircher may be that the choice of a Swedish scholar made it easier to get funding from Riksbankens Jubileumsfond and from Kungl. Vitterhets Historie och Antikvitetsakademien – funding may still be patriotic even when the historian is not. Whether such considerations have played a role or not, Eriksson should be credited for showing that Kircher is not the only possible prototype.

explanation furnished by the poem necessary.” Finally it is said about Newton’s monument in the Westminster Abbey (p. 164, photograph p. 165) that “we must admit its striking baroque character” – but the reasons for this identification are left to the reader’s appreciation of artistic styles. On p. 61, in a commentary to a quotation, the “tension between [Rudbeck’s] pride in a glorious past, hidden in pagan darkness, and the peculiar, almost humble piety that seemed to be a genuine trait of his character,” is considered to “reveal much of the spirit of his whole age.”

Apart from these observations, nothing is done to situate the characterization of Rudbeck’s work as “baroque science” relatively to a general understanding of baroque style or culture. Since “baroque science” is understood as an ideal type (albeit the ideal type that functions as a common denomination for the age), Eriksson is not likely to assume that all characteristics of every scientific writer from the seventeenth century are to be considered baroque, nor that the baroque characteristics will emerge from mere averaging (“extremes” never do). Instead, Rudbeck’s merits as a prototype appear to be accepted *a priori*, maybe because of the Enlightenment depreciation of the baroque as well as the *Atlantica* on analogous grounds – the “overstatement” and the lack of proper measure.

Which are then, according to Eriksson’s portrayal, the qualities of the *Atlantica* and of Rudbeck’s activity in general that stand forward as typically baroque features? The foremost result is perhaps that “baroque science” is not to be understood as unduly retarded Renaissance science. Because figures like Kircher and Rudbeck did not move in the direction they should according to the historiography of the triumphs of science, they are often supposed not to have moved at all. Even the Kircherophile Fred Brauen [1982: 133] quotes, with apparent acceptance, the following judgment from what Harry Torrey wrote in 1938 about Kircher’s medical studies:

He contributed no well-authenticated observation to microbiology or the history of infectious disease. He established no useful generalization. He made no stimulating suggestions for research. In his own times, he belonged to the past.

That Rudbeck was not a mere figure of the past will be clear already from his activities and interests and his empirical method as delineated above. But Eriksson also points (pp. 146f) to his understanding of symbols and

“riddles” and the ensuing “hermeneutic” approach to the sources – an approach which,

of course, had its roots in the medieval and renaissance tradition both in philology and in the studies of nature that were influenced by hermetical philosophy, mysticism, and magic. But in the *Atlantica*, mysticism was absent or reduced to minor remnants. [...].

To summarize: Rudbeck is “modern” in the sense that the myths and their actors (gods, heroes, monsters, etc.) according to him are not “true.” They also most often lack mystical content. Instead they represent, when rightly understood, riddles that concealed concrete historical and cultural facts. Natural phenomena are likewise riddles that can be solved by investigations [...].

Another instance of only seeming retardation which Eriksson explores is Rudbeck’s belief that the most ancient philosophy be also the most true. Rudbeck’s version of *prisca philosophia* reborn is, indeed, the heliocentrism ascribed to Pythagoras and the atomism of Democritus, which “Cartesius, Gassendus and others [...] have brought to light out of darkness” (p. 142), and neither Hermeticism nor Neoplatonism. This restoration of original truth “he compared [...] with Lutheran religion, which similarly reinstated the earliest Christian beliefs” (ibid.).

Eriksson, though less directly, also makes clear that Rudbeck’s outlook should not be understood as a late or more or less transformed version of Ramism. Such a suspicion would be near at hand if Comenius had been chosen as the prototype; as pointed out by Saverio Corradino, some aspects of Kircher’s thought are also rooted in Ramism although, as Corradino [1986: 56, trans. JH] is forced to conclude, Kircher “takes his distance on certain essential points, and thus presents himself [...] as an updating, or a reform, of the very Ramist reform,” while Kircher’s view of the world as a *spectaculum* puts him “at the antipodes of Ramus.”⁷

Regarding the positive characteristics of baroque science as represented by Rudbeck, Eriksson points first of all to what he sees as a common hermeneutic approach to texts and nature (cf. quotation above). Rudbeck’s and other baroque scientists’ world is, according to Eriksson, a world of “meanings” (a word to whose inherent ambivalence we shall return); he

⁷ Even in Caramuel’s writings, Ramist material is used and Ramist views on physical versus mathematical astronomy are applauded, the whole however within a definitely non-Ramist frame of thought – see [Høystrup, forthcoming].

considers (p. 160) the widespread use of surface-depth metaphors for phenomena and the causes (or structures, or whatever word we like) that determine them as evidence that the study of nature was seen on a par with the interpretation of texts (for which the “interpretation of the Bible set a standard” – p. 156).⁸ He draws the same conclusion from the recurrent references to the “book of nature” (or “book of creatures” or “book of the world”), and sees no difference between this and Kircher’s notion of the “theatre of nature.” Finally, the work of baroque scientists is, in Eriksson’s words (p. 155),

colored by their awareness of its link to the ultimate questions. They may sometimes, like Rudbeck, refrain from asking them, but they still felt their presence [...]. [...] they studied the creation, the work of the watchmaker, which meant that *the object of their study was full of meaning*.

This high ambition is seen in contrast to the ideal of “‘classical’, i.e., Newtonian, or rather post-Newtonian, science,” which (p. 153)

is not concerned with philosophical issues regarding the ultimate nature of reality. The aim of classical science is not to form an unambiguous world picture but to investigate natural objects in harmony with confined predictions – a characterization which is supposed to correspond to the general attitude of later scientists, among whom “positivism [has become] the foremost philosophical attitude” (p. 139 – “positivism” in a Viennese rather than a Comtean or a Machean sense).

Instead of thus restricting the scope of science to what can be “positively” known, Rudbeck restricted the expectations as to the truth value of the results. In Eriksson’s interpretation (p. 146):

⁸ Ironically, Eriksson discusses at some length (p. 140, plate p. ii) the frontispiece of Rudbeck’s volume of plates, in which the metaphor is clearly seen to work indeed the other way round: Rudbeck’s stands dissecting a globe, lifting the piece of skin on which is written *Suecia*, showing that underneath appears the words *Deorum insula*. For Rudbeck (as in general), the surface-depth-relation refers to anatomists’ or miners’ or similar physical experience. This provides Rudbeck with a paragon for his interpretative efforts (similar to John Donne’s *Anatomie of the World*, where it is used as a model for the scrutiny of moral decay); other writers use it to relate one kind of natural investigation to others.

Rudbeck's type of scepticism states that we can never attain certainty with regard to the ultimate questions, the deepest secrets of nature, through the use of science. But it does not deny that such a secret lies hidden in nature. Things have an ultimate origin and an essence that we are unable totally to grasp. The most radical scepticism ["pyrrhonism," to which Rudbeck did not subscribe], on the other hand, professed scepticism about whether ultimate origins or essences even existed.

In this respect, at least, Rudbeck's attitude is not far removed from what we can read in Boyle or in Newton's "General scholium"; in the Boyle-Hobbes controversy [Shapin & Schaffer 1985] whether the aim of natural philosophy is verisimilitude (Boyle) or necessary truth (Hobbes, on this account a dogmatic Aristotelian), Rudbeck takes sides with Boyle (and, since Hobbes's arguments did not convince, with the new science in general). In other regards, however, he remains a fringe figure, though treated with more esteem in his own times than later. It is therefore worth returning to the question whether Rudbeck can truly be taken as a prototype for "baroque science" considered as the ideal type for later seventeenth-century science.

In defence of this choice it was argued above that the work of "central actors" might tend to be more strictly bound "to long-lived norms and aims for the study of nature that would only to some extent bend to the pressure of a baroque (or other) *Zeitgeist*," for which reason "the best representatives of scientific activity marked by this *Zeitgeist* (the best 'prototypes') need not belong to the group of 'central actors'." If this is true, however, we must conclude that the core of the new science was only peripherally marked by the baroque *Zeitgeist* (which is thereby reduced to a "mentality," not necessarily equally characteristic for all activities of the time, and possibly only one among several competing entities of the kind). "Baroque science" may still be a relevant concept, and Rudbeck and Kircher may still represent it as adequate prototypes; later seventeenth-century science at large may also be influenced by the baroque spirit; but "baroque science" will not be the appropriate ideal type for "science of the baroque era." To the extent that the baroque is not understood as an all-pervasive *Zeitgeist* it is not even fitting to speak of a "baroque era" in European generality; if we decide with René Wellek that French classicism is not baroque, then it would indeed be strange to find this era in Boileau's and Racine's France,

however much it suits Rome of the same decades.

However, giving up the postulate of a self-defining “baroque era” forces us, if we still want to look for “baroque science,” to argue for features which this science shares with phases of culture where the concept of the baroque have already proved fruitful – and thus, ultimately, to trace the silhouette of the baroque if not directly to define or describe it. This I shall try to do in the following pages, returning afterwards to the question of baroque science – for which Rudbeck still seems to be a fair prototype, and in which connection Eriksson still has much to offer.

Connecting the emergence of the baroque to the Counter-Reformation and the Council of Trento is no new idea.⁹ According to the decisions of the Council, ecclesiastical art was to stimulate faith through emotional appeals. Obviously, the concise decree from 1563 could not in itself delineate an artistic style, baroque or otherwise; but it was filled out during the following decades by a number of theoreticians, many of whom connected to the Jesuit order, and of course implemented in real art starting from the foundation provided by mannerism, in part in continuation, in part in contrast. How the appeal to the emotions of the believers was to be understood is told thus by Gabriele Paleotti, cardinal and bishop of Bologna (*Discorso intorno alle imagini sacre e profane* I, xxv, from 1594; my translation from [Hauser 1965: 71f]):

Telling the martyrdom of a saint, the zeal and constancy of a virgin, the passion of Christ himself, are things that touch the true; but when they are present in live colours, here in front of the eyes the martyred saint, there the virgin assaulted, and on the other side the nailed Christ, this truly increases the devotion and wrings the bowels, so that he who does not feel it is made of timber or marble.

The background to this is found, e.g., in Loyola’s *Ejercicios Espirituales*, which prescribes as follows the method to “get an intimate feeling of the pains suffered by those who are condemned” (/65-70/, ed. [Schiavone 1967: 106f], my translation):

⁹ See, e.g., [Hauser 1965: 69–72] and [Wittkower 1972: 5–11], and the original discussion between Nikolaus Pevsner [1925] and Werner Weisbach [1928] (I have not been able to find Weisbach’s book on the topic from 1921).

The first point consists in seeing, with the eyes of the imagination, the great flames, and the souls as within bodies of fire. The second: to hear with the ears the weeping, howling, screaming, swearing against Christ Our Lord and all his saints. The third: to smell with the olfaction smoke, sulphur, sewers and putridity. The fourth: to try with the taste bitter things, for instance tears, gloom and the worm of conscience [...].

For both authors, the discursive argument – even the kind of argument that is implicit in a narrative – plays a secondary role, and the sensual appeal to the emotions by means of tension, colours and movement becomes primary.¹⁰ As it has been said, baroque art merges painting, architecture and the use of urban space into a *Gesamtkunstwerk*, meant to leave the spectator overwhelmed.

A general framework within which these facets of baroque culture can be understood is Habermas's theory of the "public sphere" [Habermas 1968] in somewhat revised form. The essential point is the distinction between two (ideal) types of "public sphere" (where a "public sphere" may be understood as the social and discursive space within which a group or society as a whole fashions and maintains a common world view and common norms and shapes the common will for action). One type (identified by the young Habermas exclusively with bourgeois culture) is built on the discursive reasoning of all accepted members of the community in question on an equal footing (where acceptance may depend on possession of the required cultural level or some kind of generalized citizenship). By necessity, this space presupposes some kind of shared foundation for reasoning – "axioms" for short; in Habermas's idealized view of the early bourgeois public sphere thus the *laissez-faire* inviolability of the economic sphere; its character invites to a Humean distinction between descriptive and prescriptive statements, between "is" and "ought," between ends and means. In general we might speak of an "argumentative public sphere." The other type is the "public sphere of representation," where "truth" (prescriptive and descriptive at a time) is demonstrated *ad*

¹⁰ In general, it is true, the *Ejercicios Espirituales* seem to rely heavily on the narratives of the Gospel; but these narratives are always to be reflected upon in such a way and within such a framework that the argument and understanding of the dogma gives way to devotion and quasi-mystical (or fully mystical) emotion.

oculos, as in the late medieval tournament (leaving no doubt as to social preeminence and superiority as regards physical power) and the ecclesiastical ritual. It cannot be argued with by the spectator, at most rejected or derided, as in the Reformation dismissal of the Latin Eucharist ritual as “*hocus-pocus*.”

According to the Trentine decree or to Paleotti, ecclesiastical art was to serve as such a demonstration of truth – you cannot discuss with the wringing of your bowels, nor with what leaves you overwhelmed. Courtly baroque architecture was similarly intended to display the supreme power of the absolute state, and so was that kind of baroque opera where “the public could admire the horse who drew the sun’s carriage flying over the stage floor with Phaeton at the reins” (Eriksson, 158).

But the baroque, as soon as it unfolded, developed into more than a cultural expedient for the indoctrination of the masses, be it ecclesiastical (Catholic or Lutheran), be it absolutist-political. Another theoretician of the incipient baroque is Clavius’s colleague at the Collegio Romano, in whose *Tractatio de Poësi et Pictura ethnica, humana et fabulosa collata cum vera, honesta et sacra* (1595, ed. [Barocchi 1978: II, 458], my translation) we find that

the painter should take advantage of the whole of philosophy, in particular of moral philosophy, since the depiction of the soul and the expression of all its sentiments, agitations and other commotions makes the art of painting deserve the highest praise. The soul, indeed, being various, irascible, just, inconstant, and abominable, clement, sweet, compassionate, sublime, vainglorious, humble, proud, and frivolous, who is able to do that is certainly not lacking of acuteness of mind.

This awareness and acceptance of ambiguity becomes characteristic of the mature baroque, in particular of the learned poets; we may surmise an influence from the Mannerist background that conditioned the shaping of the baroque programme. We may confront a passage from a sermon written by John Donne in 1626 [ed. Craik & Craik 1986: 178],

I throw myself down in my chamber, and I call in and invite God and his angels thither, and when they are there I neglect God and his angels for the noise of a fly, for the rattling of a coach, for the whining of a door. I talk on, in the same posture of praying, eyes lifted up, knees bowed down, as though I prayed to God; and if God or his angels should ask me when I thought last

of God in that prayer, I cannot tell. [...] A memory of yesterday's pleasure, a fear of tomorrow's dangers, a straw under my knee, a noise in mine ear, a light in mine eye, an anything, a nothing, a fancy, a chimera in my brain, troubles me in my prayer,

with the conviction of Loyola (*Ejercicios Espirituales* /346ff/) that such confusions of the mind are to be ascribed to the Fiend. Where the champion of the Counter-Reformation procures dichotomic clarity by means of projection and reification, there the baroque poet acknowledges the quiet disorder of the human mind proper.

Acceptance of, and even enthusiasm for ambiguity, is also expressed by seventeenth-century theoreticians of baroque interpretation. "The whole machine of the world is full of Proteus. Wherefore let us grasp a Proteic pen, that we may be able to praise Proteus" – thus Caramuel in the work [1663a, *Apollo analexicus* p. 1] from which we already quoted the explanation of the logogriph as a creator of ambiguity and multiple significations.

As a rule, the baroque theoreticians were more interested in uncovering the ambiguities of the human mind than those of the world; thus Possevino, thus also John Donne, in the above quotations. Thus even Caramuel, when in a work from 1635 he redefines "steganography," a cryptographic play with letters hitherto kindred to Cabala and necromancy, as "the secure art to make manifest to those absent the secrets of the mind by means of a concealed writing" (my translation from quotation in [Pastine 1975: 47]).

On this background, we may return to the issue of "baroque science." First of all, if the baroque is essentially intertwined with a public sphere of representation, it seems to be in conflict with the quintessence of scientific activity (inasmuch as this presupposes discussion and formulation of arguments) and with the new social organization of seventeenth-century science, with its scientific academies, letter-circles and emerging scientific journals.¹¹ The contradiction is not absolute – even baroque theoreticians

¹¹ In contrast, the "courtly science" of the Renaissance as discussed by William Eamon [1991: 35–37], with its "fascination with and the display of *meraviglia*, which is best seen in the princely gardens and cabinets of curiosities [...] symbolically demonstrating the prince's dominion over the entire natural and artificial world,"

argued for their stance; but it was certainly felt. Galileo, whose talent for striking his opponents at their weak points equalled his scientific genius, appealed to it in his famous attack on Horazio Grassi, the Collegio-Romano mathematician who had been unkind enough to show that Galileo did not always look too closely when performing his experiments (*Il saggiaiore*, trans. [Drake & O'Malley 1960: 183]):

It seems to me that I discern in Sarsi [Grassi's pseudonym – JH] a firm belief that in philosophy it is essential to support oneself on the opinion of some celebrated author, as if when our minds are not wedded to the reasoning of some other person they ought to remain completely barren and sterile. Possibly he thinks that philosophy is a book of fiction created by some man, like the *Iliad* or *Orlando furioso* – books in which the least important thing is whether what is written in them is true.

Grassi's error had been to supplement the empirical arguments for his views with “ornaments and decorations” (in Rudbeck's sense), for instance references to such ancient poets who wrote about natural phenomena (Lucrece, Ovid). He was right and Galileo wrong – the comets were farther away than the moon, and they were physically real objects; but even though he had taken care to distinguish the core of the argument from

with “Carved gems, watches, antiques, mummies and mechanical contrivances [...] displayed side by side with fossils, shells, giant's teeth, unicorn's horns, and exotic specimens from the New World,” is a perfect element of a public sphere of representation, in neat agreement with its political purpose as seen by Eamon, viz to represent “the prince as a repository of praeternatural, superhuman secrets.” But the importance of this type of scientific institution was already waning in the earlier seventeenth century, though still reflected in Galileo's naming of the “Medicean stars” – cf. Biagioli's analysis of this event [1990]; concomitantly, the *Wunderkammer* was developing into a museum. In the Florentine courtly Accademia del cimento, even the Medici Prince Leopold, when participating in the meetings, liked “to act as an Academician, and not as a Prince,” being “content to play the second role only on occasions when there is a question of expense, generously supplying the needs of the Academy,” as told by the secretary of the academy in 1664 (Lorenzo Magalotti, quoted from [Middleton 1971: 56f]). It is immaterial whether Magalotti knew and rendered faithfully the Prince's inner feelings on the issue; what matters is that the prince, if he wanted to be a member of the world of science, had to accept the rules of an argumentative public domain.

the decorations, Grassi had put himself in the loosing position.¹²

The question of the public sphere must also be taken into account in relation to the “book” and “theatre” of nature. First of all it must of course be remembered that this metaphorical book mostly had a polemical function in the seventeenth century. This was the case when Galileo opposed to Grassi’s dusty poets and doxographers that “book of nature” which is wide open to everybody’s eyes and imputed to Grassi the view that *his* philosophy was akin to those books of fiction in which “the least important thing is whether what is written in them is true”; it was no less true when Descartes confronted in the introduction to *Discours de la méthode* the “grand book of the world” [ed. Simon 1850: 6] with the old books which he had read at the Jesuit college of La Flèche; and the contrast was manifest albeit in weakened form even when Rudbeck referred to “Nature who is the most wise and certain of books” (Eriksson, p. 50) – indeed another way to express the relation between the perennial certainty of the fundamentals of his building and its less stable walls and roof. The function of the metaphor was thus to establish for philosophy (of nature, or generally) a new set of axioms on which argumentation had to be built – no longer the writings of the ancient authorities but experience and experiment. In any case, the real book, reservoir of explicit statements and arguments, belongs within a public sphere of argumentation. So does the metaphorical book of nature, still a reservoir of arguments which are not yet formulated in words but which can still be “seen” even though this may require that we cut away a layer of skin and muscles or apply a microscope; Newton, we should not forget, counted the whole Copernican system among his “phenomena” in book III of the *Principia*.

The theatre, on the other hand, real as well as metaphorical, belongs with a public sphere of representation – *pace* Eriksson, according to whom (pp. 157f) the theatre, “like a book, [is] a collection of significances, something to be studied and interpreted if you were non content with superficial enjoyment.” When a scholar like Kircher enjoyed and described the theatre of nature he put himself and the reader precisely in the position

¹² To which extent he had done so can be illustrated by a bit of statistics: The Vatican Library possesses two copies of each of Grassi’s intervention, but no less than six of Galileo’s *Saggiatore*.

of the spectator to Lully's *Phaeton*, admiring "the horse who drew the sun's carriage flying over the stage." The moral messages which might be gained from this spectacle were gained, then as now, by other methods of analysis than mere "looking." What the new philosophers of nature would do with the opera is aptly described by Fontenelle, whose *Entretiens sur la pluralité des mondes* Eriksson paraphrases (p. 158) without observing the difference between the two approaches: they, indeed, would not behave like

the philosophers who in ancient times had looked at the astronomical phenomena [and] had spoken of the movements of the heavenly bodies without insight in the real machinery, being mostly overawed by the scenery as a spectacle regulated by secret forces [...], one saying that some secret force lifted Phaeton; another that certain numbers of which he was composed made him fly; a third that Phaeton had a predilection for a position in the upper parts of the theater [...]. [Instead], Descartes and other modern philosophers had declared that Phaeton flew because he was moved by ropes and that a weight heavier than him dropped to the floor.

This is exactly what the same philosophers did when "reading the book of nature," and it implied that they did not accept the theatrical spectacle as theatre and did not ask for significations. Kircher's favourite metaphor exhibits his affinity with baroque culture – he did not primarily look analytically at the details but at the impressive *Gesamtkunstwerk* of nature; as Fontenelle explains the new philosophy it already stands out as an enlightenment movement exposing the mystifications of old. This, rather than baroque mentality, is the implication of the seventeenth-century metaphor of the "book of nature" – even when it is used by Rudbeck, however much he may be baroque in other respects.

These respects (apart from "overstatement") have to do with the issue of "meaning" and "meaningfulness." At this point it is important to observe an essential break which took place in the early seventeenth century. Since Kepler is often referred to as "a renaissance Platonist and mystic" – thus also by Eriksson – he may serve to illustrate the shift. In the introduction to an astrological calendar for the year 1602 [ed., trans. Field 1984] he distinguishes between zodiacal and aspectual astrology.¹³ The former

¹³ Quite interestingly, Kepler uses the same metaphor as Rudbeck, defining himself as a "Lutheran" astrologer, "throwing away the nonsense and keeping the kernel" of the subject.

builds on a human construct, the artificial division of the Zodiac; such a division can have no influence on *reality*, whence this brand of astrology must be rejected as pure superstition, kindling and exploiting “the crowd’s craving for marvels.” Aspects, on the other hand – conjunction, opposition, and the other harmonious angular distances – are real, and may well influence other real phenomena if the universe is governed by harmony; the familiar phenomenon of spring and neap tide is one indubitable example, and it would be rash to exclude that others may exist. The objective harmony of the physical world is something quite different from human signification and symbolization; the former, if it exists, is a feature of Descartes’ *res extensa*, while the latter belongs within his *res cogitans*, and Kepler discriminated as clearly as Descartes between the two. The sixteenth century, in particular the occult and Hermetic currents, did not; hence the prominence of the doctrine of “signatures” in sixteenth-century medicine, based exactly on the coincidence between human symbolization and physiological efficiency, and its waning in the seventeenth century; hence the belief of even “modern” sixteenth-century minds like Jean Bodin in the possibility of magic, and its decline in the seventeenth century, culminating in Louis XIV’s decree from 1682 that sorcerers were to be treated as charlatans [Monter 1980: 35]. In the sixteenth century, studying the “work of the watchmaker” might mean that the “object of study was full of meaning,” as formulated by Eriksson; to seventeenth-century scientists (and eighteenth-century physico-theologians), however, it would only mean that it was *full of purpose*, which (at least from then on) was a wholly different matter.

The discovery that symbols and significations are human – “subjective” with a later term – and not “objective” was not the preserve of the new science but belonged as much with baroque thought (and quite naturally so if we think of its start from intentional and purposeful *construction* of significations). In both spheres, if we distinguish them, survivals of old attitudes can also be found; Kircher is not free of traces, but even Boyle, when expressing his unwillingness to “impute all those diseases to witchcraft, which even learned men father upon it,” does not reject the possibility of witchcraft altogether [*The usefulness of Natural Philosophy* II.v; *Works* II, 159]. The difference is rather to be found in the attitude to the

use of symbolization; typically baroque writers accept their ambiguity, and do not shrink from using it in their expositions; to them, it serves as a means to grasp and render a world “full of Proteus.” They may combine two different etymologies of the same term, knowing not only that at most one can be true but indeed that both are false, and combine them in order to approach in poetical fashion the essence of the phenomenon they describe. A fine example of this is found in Caramuel’s *Mathesis biceps* ([1670: I, 118], my translation). Caramuel is quite aware that the “art of the coss” (algebra) takes its name from *cosa*, “thing,” which as a Spaniard he prefers to categorize as Spanish instead of Italian; but “in case you do not want to favour the Spaniards” he is able to offer Arabic, Hebrew, Greek and Latin alternatives – for instance “ $\aleph \zeta \eta$ QAZA, *Iudicavit*, et $\aleph \zeta \eta$, QAZAR, *Brevis fuit*,” which he combines into an suggestion that algebra be “a critical arithmetic, and most certain in matters numerical. A guide which solves with the highest certainty and brevity such difficulties which ordinary arithmetic is hardly able to decide in indirect and labyrinthine ways.” This, indeed, is what Caramuel wants to make us understand about algebra.

As we have seen, Rudbeck based much of his argument on “decorations” which he refused to consider as true in the straightaway sense, fusing for instance several etymologies into one when it suited him. But his acceptance of ambiguity went further; when (Eriksson, p. 37)

It cannot be said for certain whether Rudbeck meant that one, three or six kings headed the army; if Saturn took part in the conquest or only consented to its accomplishment; or if Thor was the real leader of the enterprise or not

or when “the three sons of Sadur, Jofur, Neptune, and Pluto,” after having been dealt with as distinct persons, suddenly become “one and the same person, viz., Jofur, in his three royal offices, as lawgiver and administrator, as chief of the military forces, and as high priest and teacher” (ibid., p. 74), then the ultimate reason is hardly “Rudbeck’s complicated argument” or his inability to tell or keep track of what he means, but rather that these Protean transformations within the narrative allow him to convey the message that he wants to get through (in the latter example thus, via the passage from Eusebius from which this tripartition is borrowed, that the Hyperborean Swedes went as far as India and Sumatra). Since the very material on which he based the argument was itself ambiguous and

constructed as riddles (*consciously* constructed so as to disguise reality and at the same time invite its unmasking, to paraphrase Eriksson), this could only be a legitimate procedure – since Rudbeck “did not live in the time of Troy or before,” the kind of truth he told would by necessity share some of the characteristics of the emblematic riddles on which he had to rely.

But here the core of the new science would part company. It would often share the moderate scepticism of a Rudbeck, accepting that the results it had obtained and the theories it had framed were not certain or absolute truth; but it definitely did not accept, let alone rejoice in ambiguity. Bacon had believed that nature could be analyzed into a restricted number of “simple natures,” Descartes had wanted to emulate in his *méthode* [ed. Simon 1850: 13f] the mechanical calculation of algebra to be sure that memory did not deceive him, and had gone for the “clear and distinct” conceptions (ibid. p. 12);¹⁴ Galileo was always sure that he was right – his admonitions not to regard theories as more than *possible* explanations of phenomena were meant for Grassi, not for himself (else he would have seen that this was exactly what Cardinal Bellarmine had told *him*); Pascal and Arnauld, horrified by the assertion that “in matters of faith and morality, it suffices for the assurance of the tranquillity of conscience to follow a probably opinion” ([Caramuel 1663b: A3], my translation), invented that quantification of probability which allowed to single out one opinion as *the most* probable and hence the one to be followed unambiguously. The idea of the “crucial experiment,” common to Bacon and Descartes, not only echoes the credo of logical simplicity – *tertium non datur* – but insinuates a strong and unwarranted generalization – only the two possibilities that *I* am able to imagine are possible.

In conclusion, the parameters “public sphere,” “meaning” and “ambiguity”

¹⁴ This Cartesian ideal, remote as it is from the outlook of a Possevino, a Rudbeck or a Caramuel, shows how far the unfolded baroque had moved away from the goals of the Counter-Reformation. It seems, like the Plotinian argument of perfection, to be part of the mental luggage that Descartes carried along from La Flèche without noticing so: such clarity of ideas is indeed one of the conditions for a good and sane *choice*, according to Loyola’s *Ejercicios Espirituales* (/176/, ed. [Schiavone 1967: 174])

seem to allow us to discriminate in seventeenth-century natural philosophy or science three main orientations – polarities or ideal types even they, it goes by itself, not boxes within precisely one of which every actor has to belong.¹⁵

(i) Delayed sixteenth-century postures, represented for instance by Steno's teacher Olaus Borrichius, still a believer in the truth of the Hermetic writings (see [Rattansi 1979]), and Robert Fludd (in as far as this figure should at all be counted to the field of science). These are writers who had not accepted that symbols be products of the human mind and do not belong to or act on nature; "ambiguity" is probably an irrelevant category inasmuch as they are concerned. Their fondness of "wonders" connects them to a public sphere of representation.

(ii) The baroque orientation, represented by scholars like Rudbeck, Kircher and Caramuel. With a slight reservation for Kircher (whose "credulity," as contemporaries would call it, might approach him on this account to the first group), they would regard symbols as human products, emblems or "riddles," if loaded with "secrets" then the secrets of the human mind. Since theirs was an ambiguous world, they would make ample use of these emblems when speaking about it; to some extent their public-sphere orientation would again be of the representation type, but what they wanted to represent on the stage was not the certainty of authority (or of the Hermetic or Paracelsian magus) but rather Protean elusiveness. When elusiveness was not involved, and their arguments were correspondingly unambiguous, they would participate (with greater or, more often, lesser success – the members of the third group rarely took them quite seriously) in the common public sphere of the new science, of unmistakable argumentative type.

(iii) The core of the new philosophy, represented by the culture heroes of central and later seventeenth-century science: Descartes, Pascal, Boyle, Huygens, Steno, etc. No less convinced than the baroque writers that poetical symbols were human products they would keep them out of their scientific writings, as liable to spawn only confusion in a domain where

¹⁵ No doubt, other parameters would allow us to discriminate in other ways, for instance between Cartesian certainty and system-building and Boylean caution. But these other divisions do not concern Eriksson's analysis or the baroque question.

clarity should prevail, *even when it came to the exposition of doubts*, which should be explained, not copied into ambiguous emblems.¹⁶ In order to publicize among the unlearned social elite, it might resort to representation, as when von Guericke demonstrated the power of his vacuum with a team of horses (on one occasion to the Great Elector in Berlin – [Krafft 1972: 575]) – “truly a spectacle of baroque dimensions” (Eriksson, p. 153), but precisely because of the actual situation no reason to classify von Guericke’s scientific orientation as baroque;¹⁷ as argued above, however, the internal organization of the new science was that of an argumentative public sphere.

Eriksson’s suggestion to regard “baroque science” as the central ideal type against which later seventeenth-century science should be held up is thus less than convincing – in any case it did not convince the present reviewer. The reason is first of all that his book never gives more than superficial arguments that those general characteristics of seventeenth-century science at which it points have any relation to the baroque style or mentality known from other branches of contemporary culture – or, in a different formulation, never explains (or merely asks) why it is reasonable to postulate a single *Zeitgeist* or denomination “common to all branches of culture” of the age and to be described as “baroque.” None the less, *The Atlantic Vision* remains an important book, already for its portrayal of the loveable Olaus Rudbeck but even more so because of its introduction of a novel and stimulating perspective on seventeenth-century science.

¹⁶ It is not a fully gratuitous observation that these two ways to relate to doubts – explaining and discussing, or demonstrating directly *ad oculos* – reflect the relation between the argumentative and the representative public spheres.

¹⁷ Even the public experiments of the Royal Society – intended, no less than von Guericke’s valiant horses, for an elite whose support it was important to gain, but which was not in itself too competent in the matter – could be classified as instances of representation.

References

- Barocchi, Paola (ed.), 1978. *Scritti d'arte del Cinquecento*. 9 vols. Torino: Einaudi.
- Biagioli, Mario, 1990. "Galileo's System of Patronage." *History of Science* **28**, 1–61.
- Boyle, Robert, *The Works*, ed. Thomas Birch. With an Introduction by Douglas McKie. 6 vols Hildesheim: Olms, 1965–66. Reprint of London ²1772.
- Brauen, Fred, 1982. "Athanasius Kircher (1602–1680)." *Journal of the History of Ideas* **43**, 129–134.
- Caramuel, Juan, 1663a. *Primus Calamus ob oculos ponens Metametricam*. Romae: Fabius Falconius. (The work is not continuously paginated, the chapters are entitled "Apollo ...").
- Caramuel, Juan, 1663b. *Apologema pro antiquissima et universalissima doctrina, de probabilitate. Contra novam, singularem, improbabilemque D. Prosperi Fagnani opinionationem*. Lugduni: Sumptibus Laurentii Anisson.
- Caramuel, Juan, 1670. *Ioannis Caramuelis Mathesis biceps. Vetus, et nova*. 2 vols. Campania: In Officina Episcopali.
- Corradino, Saverio, 1986. "Kircher e Ramus," pp. 46–61 in Maristella Casciato, Maria Grazia Ianniello & Maria Vitale (eds), *Enciclopedismo in Roma Barocca. Athanasius Kircher e il Museo del Collegio Romano tra Wunderkammer e museo scientifico*. Venezia: Marsilio.
- Craik, T. W., & R. J. Craik (eds), 1986. *John Donne, Selected Poetry and Prose*. London & New York: Methuen.
- Drake, Stillman, & C. D. O'Malley (eds, trans.), 1960. *The Controversy of the Comets of 1618. Galileo Galilei, Horatio Grassi, Mario Guiducci, Johann Kepler*. Philadelphia: University of Pennsylvania Press.
- Eamon, William, 1991. "Court, Academy and Printing House: Patronage and Scientific Careers in Late Renaissance Italy," pp. 25–50 in Bruce T. Moran (ed.), *Patronage and Institutions. Science, Technology and Medicine at the European Court, 1500–1750*. Rochester, New York: Boydell & Brewer.
- Field, J. V., 1984. "A Lutheran Astrologer: Johannes Kepler." [Includes a translation of Kepler's *De fundamentis atrologiae certioribus*]. *Archive for History of Exact Sciences* **31**, 189–272.
- Habermas, Jürgen, 1968. *Strukturwandel der Öffentlichkeit. Untersuchungen zu einer Kategorie der bürgerlichen Gesellschaft*. 3. Auflage. Neuwied & Berlin: Luchterhand.
¹1962.

- Hauser, Arnold, 1965. *Il Manierismo. La crisi del Rinascimento e l'origine dell'arte moderna*. (Biblioteca di storia dell'arte, 4). ²Torino: Einaudi.
- Hofmann, Joseph Ehrenfried, 1953. *Geschichte der Mathematik*. 3 Bände. (Sammlung Göschen 226, 875, 882). Berlin: Walter de Gruyter, 1953–1957.
- Hooykaas, Reijer, 1972. *Religion and the Rise of Modern Science*. Edinburgh: Scottish Academic Press.
- Høyrup, Jens, forthcoming. “Barocco a scienza secentesca: un legame inesistente?” To appear in *Analecta romana Instituti Danici*.
- Koch, Ludovica, 1983. “Rime, arditezze e ragioni,” pp. 169–194 in *Etimologia: Pratiche e invenzioni* (Fabrica 1. Quaderni di retorica e di euristica letteraria). Napoli: Istituto Universitario Orientale.
- Krafft, Fritz, 1972. “Guericke, Otto von”, pp. 574–576 in *Dictionary of Scientific Biography*, vol. V. New York: Scribner.
- Metcalf, George J., 1974. “The Indo-European Hypothesis in the 16th and 17th Centuries,” pp. 233–257 in D. Hymes (ed.), *Studies in the History of Linguistics. Traditions and Paradigms*. Bloomington & London: Indiana University Press.
- Middleton, W. E. Knowles, 1971. *The Experimenters: A Study of the Accademia del cimento*. Baltimore: Johns Hopkins Press.
- Monter, E. William, 1980. “French and Italian Witchcraft.” *History Today* 30:11, 31–35.
- Pastine, Dino, 1975. *Juan Caramuel: Probabilismo ed enciclopedia*. («Centro di Studi del pensiero filosofico del Cinquecento e del Seicento in relazione ai problemi della scienza» del Consiglio Nazionale delle Ricerche. Serie I – Studi, 5). Firenze: La Nuova Italia.
- Pevsner, Nicolaus, 1925. “Gegenreformation und Manierismus.” *Repertorium für Kunstwissenschaft* 46, 243–262.
- Rattansi, P. M., 1970. “Borrichius (or Borch), Olaus,” pp. 317–318 in *Dictionary of Scientific Biography*, vol II. New York: Scribner.
- Rudbeck, Olaus, 1679. *Atland Eller Manheim. Dedan Japhets afkomne, de förnemste Keyserlige och Kongelige Slechter ut til hela werlden, henne at styra, utgångne äro, så och dess efterföljande Folk utogade, nemligen Skyttar, Borbarn, Asar, Jettar, Giotar, Phryger, Trojaner, Amaizor, Traser, Lyber, Maurer, Tussar, Kaller, Kiempar, Kimrar, Saxer, German, Swear, Longobarder, Wandaler, Herular, Gepar, Tydskar, Anglar, Paitar, Danar, Sidkampar, och de som i werket wisas skola. Atlantica Sive Manheim. Vera Japheti posterorum sedes ac patria, ex qua non tantum Monarchae et Reges ad totum fere orbem reliquum regendum ac domandum, Stirpesque suas in eo condendas, sed etiam Scythae, Barbari, Asae, Gigantes, Gothi, Phryges, Trojani, Amazones, Thraces, Libyes, Mauri, Tusci, Galli, Cimbri, Cimmerii, Saxones, Germani, Svevi, Longobardi, Vandali, Heruli, Gepidae, Teutones, Angli, Pictones, Dani, Sicambri,*

- aliique virtute clari et celebres populi olim exierunt.* Upsalae: Excudit Henricus Curio S.R.M. & Academiae Upsal. Bibliopola, s.d.
- Schiavone, Pietro, S.J. (ed.), 1967. Sant'Ignazio di Loyola, *Esercizi spirituali*. Roma: Edizioni Paoline.
- Shapin, Stephen, & Simon Schaffer, 1985. *Leviathan and the Air-pump: Hobbes, Boyle, and the Experimental Life*. Princeton, N. J.: Princeton University Press.
- Simon, Jules (ed.), 1850. *Œuvres de Descartes*. Paris: Charpentier, 1850.
- Weisbach, W., 1928. "Manierismus und Gegenreformation." *Repertorium für Kunstwissenschaft* **49**, 16–28.
- Wellek, René, 1968. "Baroque in Literature," pp. 188–195 in *Dictionary of the History of Ideas*, vol. I. New York: Scribner.
- Wittkower, Rudolf, 1972. *Arte e architettura in Italia: 1600–1750*. (Biblioteca di storia dell'arte, 14). ²Torino: Einaudi.