Was there a Baroque science in seventeenth-century Western Europe? And if so, how did it look?

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The watershed

"Modern European science" is inaugurated by such 17th-c. figures as Galileo, Kepler, Harvey, Descartes, Pascal, Huygens, Boyle, Hooke, Steno, Newton, ...:

Copernicus, Tycho, Cardano, Vesalius, Bombelli, ... – and Dee, della Porta, Paracelsus, ...

carry the ancient and medieval inheritance beyond the bursting point but leave synthesis to a future generation.

Even in human/social science:

The natural law doctrines of Hobbes, Locke and Pufendorf and the *Grammaire générale* of Arnauld and Lancelot are "modern" Machiavelli forebodes modern political thinking in a way which makes his ancient models crack but does not yet reconstruct. It is customary to categorize Paracelsus, Copernicus, Vesalius, Cardano, Dee, Brahe, Bombelli and della Porta as "Renaissance scientists" indeed not difficult to point to features of their thought that are widespread within the Renaissance movement.

In contrast, there is no tradition for seeing Galileo, Kepler, Harvey, Descartes, Pascal, Huygens, Boyle, Hooke, Steno, Newton, Hobbes, Locke, Pufendorf and Arnauld as exponents of "the Baroque", which art historians see as characteristic of the epoch.

Is this a historical or a historiographical conundrum?

- is it true that the New Science (or "new philosophy") and the Baroque represent contemporary but unconnected or perhaps even conflicting cultural currents?
- Or have historians of science simply been blind to the relation between the two?

Otherwise: Is the **Baroque a context without (scientific) texts**, or is it simply in disrepute among historians of science?

I was struck by the question some 25 years ago when teaching the history of the humanities:

Why has the Spanish *siglo de oro* apparently left no traces calling for the attention of historians of science?

My intuitive hunch by then: at least the "etymological current" in linguistics might have to be understood within the Baroque framework.

In Sweden and Denmark this current is best known through Olaus Rudbeck's *Atlantica*.

My starting point thus similar to that of Gunnar Eriksson's in *The Atlantic Vision: Olaus Rudbeck and Baroque Science*; but we soon went different ways.

Delimitation of the Baroque

This was in any case a dubious intuition as it stands.

In order to get a meaningful question we have to go beyond the everyday understanding of the Baroque as mere "baroque", as mere contrast to the classicist ideal of "noble simplicity and quiet greatness".

Is it possible to define, to delimit, or at least to characterize the Baroque?

A first strategy: the chronological approach.

This is familiar from the commonsense historiography of European music; everything between Monteverdi and Bach is "baroque music" simply because of its date.

It is the approach of Reijer Hooykaas and J. E. Hofmann.

- Hooykaas: modern science was produced by "scientists of the Renaissance and Baroque periods"; the Baroque is a period, no style of art or thought.
- Hofmann's ultra-concise *Geschichte der Mathematik* has chapter headings "Übergang zum Barock (1450–1580)", "Frühbarock (etwa 1550 bis 1650 n. Chr.)"; "Hochbarock (etwa 1625 bis 1665)"; and "Spätbarock (etwa 1665 bis 1730)" – apparently periods inspired by German visual art.

In this way, everything is easy: Arnauld is neither more nor less Baroque than Rudbeck.

The problem is neither historical nor historiographical but *linguistic*: the Baroque concept is empty and can be discarded.

But then, Racine is neither more nor less Baroque than Calderón. If we insist that there *is* a difference and speak of Baroque in the history of art and literature, our problem returns:

If the Baroque exists as a *particular* current of seventeenth-century European elite culture within which Calderón belongs but to which Racine is in opposition, then it is still legitimate and meaningful to ask whether *this* particular current imprinted the New Science of the seventeenth century.

This corresponds to what the literary historian René Wellek says on "Baroque in Literature":

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.

Obviously, a <mark>"current" or "movement</mark>" cannot be strictly defined. Even a delimitation cannot be exact.

Yet we may strive to *dig out central characteristics*, features which distinguish the core of the current but only in weakened form or not all together when we look at its periphery.

In its origin, the Baroque is linked to the Counter-Reformation and the Jesuit order.

In 1563, the Council of Trent (which defined the Counter-Reformation) issued a decree stating among many other things that ecclesiastical art was to serve the propagation and consolidation of orthodox faith:

And if any abuses have crept in amongst these holy and salutary observances, the holy Synod ardently desires that they be utterly abolished; in such wise that no images, (suggestive) of false doctrine, and furnishing occasion of dangerous error to the uneducated, be set up. And if at times, when expedient for the unlettered people; it happen that the facts and narratives of sacred Scripture are portrayed and represented; the people shall be taught, that not thereby is the Divinity represented, as though it could be seen by the eyes of the body, or be portrayed by colours or figures. Moreover, in the invocation of saints, the veneration of relics, and the sacred use of images, every superstition shall be removed, all filthy lucre be abolished; finally, all lasciviousness be avoided; in such wise that figures shall not be painted or adorned with a beauty exciting to lust [...]. (continued)

In fine, let so great care and diligence be used herein by bishops, as that there be nothing seen that is disorderly, or that is unbecomingly or confusedly arranged, nothing that is profane, nothing indecorous, seeing that holiness becometh the house of God.

And that these things may be the more faithfully observed, the holy Synod ordains, that no one be allowed to place, or cause to be placed, any unusual image, in any place, or church, howsoever exempted, except that image have been approved of by the bishop".

That could not and did not determine how and what art should *be*, at most what it should *not* be – the loincloth painted over Michelangelo's naked Christ in the Sistine Chapel is an almost parodic example.



In so far, the emergence of the Baroque can be seen in the perspective of an observation made by Carlo Ginzburg regarding

a problem the significance of which is only now beginning to be recognized: that of the popular roots of a considerable part of high European culture, both medieval and postmedieval. Such figures as Rabelais and Brueghel probably weren't unusual exceptions. At the same time, they closed an era characterized by hidden but fruitful exchanges, moving in both directions between high and popular cultures. The subsequent period was marked, instead, by an increasingly rigid distinction between the culture of the dominant classes and artisan and peasant cultures, as well as by the indoctrination of the masses from above. We can place the break between these two periods in the second half of the sixteenth century, basically coinciding with the intensification of social differentiation under the impulse of the price revolution. But the decisive crisis had occurred a few decades before, with the **Peasants' War** and the reign of the **Anabaptists** in Münster. At that time, while maintaining and even emphasizing the distance between the classes, the necessity of reconquering, ideologically as well as physically, the masses threatening to break loose from every sort of control from above was dramatically brought home to the dominant classes. (continued)





This renewed effort to achieve hegemony took various forms in different parts of Europe, but the evangelization of the countryside by the Jesuits and the capillary religious organization based on the family, achieved by the Protestant churches, can be traced to a single current. In terms of repression, the intensification of witchcraft trials and the rigid control of such marginal groups as vagabonds and gypsies corresponded to it. The *implementation* of the Trent programme was necessarily made on the foundation of existing art, that is, the *Mannerist* trend.



MICHELANGELO Buonarroti The Conversion of Saul 1542-45 Fresco, 625 x 661 cm Cappella Paolina, Palazzi Pontifici, Vatican Further with strong regard for Ignazio de Loyola's insight in the importance of the active emotional involvement of the recipient.

As explained in his *Spiritual Exercises*:

[...] if the person who is making the contemplation, takes the true groundwork of the narrative, and, discussing and considering for himself, finds something which makes the events a little clearer or brings them a little more home to him [...] he will get more spiritual relish and fruit, than if he who is giving the Exercises had much explained and amplified the meaning of the events. For it is not knowing much, but realizing and relishing things interiorly, that contents and satisfies the soul.

This is in clear conflict with the rationalist-theological Trent request that the people shall be taught, that not [by religious images] is the Divinity represented, as though it could be seen by the eyes of the body, or be portrayed by colours or figures. Essential is not the presentation of the religious motif by itself but the motif embedded in a totality of tension, colour and movement;

How is one to get an "interior sense of the pain which the condemned suffer"?

The first Point will be to see with the sight of the imagination the great fires, and the souls as in bodies of fire. The second, to hear with the ears wailings, howlings, cries, blasphemies against Christ our Lord and against all His Saints. The third, to smell with the smell smoke, sulphur, dregs and putrid things. The fourth, to taste with the taste bitter things, like tears, sadness and the worm of conscience. The fifth, to touch with the touch; that is to say, how the fires touch and burn the souls.

This was <mark>transferred to the realm of art</mark>:

Gabriele Paleotti, cardinal and bishop of Bologna, *Discorso intorno alle imagini sacre e profane*:

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.

This shows another aspect of the Baroque: the Baroque work of art is a *Gesamtkunstwerk*, a planned totality where all elements are to fit together – in good agreement with the connection between the Baroque and court culture.

With Habermas: the Baroque is a "representative public sphere", the exhibition of "truth" *ad oculos*, beyond possible doubt or reasoned debate (but not beyond idiosyncratic personal interpretation).

A "public sphere": locus for the creation of collective conviction.







A strong emotional involvement of the flock impedes criticism and rational doubt and is thus fundamental for the functioning of a representative public sphere;

The clerical insight in the necessity of emotional involvement prevented the degeneration of art into one-dimensional didactic, however much the bishops from Trent had aimed at exactly that.

Antonio Possevino (Jesuit, <mark>friend of Clavius</mark>), Tractatio de Poësi et Pictura ethnica, humana et fabulosa collata cum vera, honesta et sacra (1595):

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, he who is able to do that is certainly not lacking in acuteness of mind.



BERNINI, Gian Lorenzo The Ecstasy of Saint Therese 1647-52



 re Ginzburg, we take note of the contrast between Possevino's (general Jesuit) outlook and the one-way moralizing of Puritanism and Lutheran orthodoxy:

None of these could accept a similar inextricable conglomerate of good and evil.

Maybe it is no accident that witch burning was less common in regions where Jesuit Baroque culture was strong than in Lutheran areas. Erudite Baroque poetry – say, that of Góngora, Donne and Gryphius – is not at all fit to serve "the indoctrination of the masses from above", and in so far not easily related to the Trent decree and its definition of the tasks of (church) art.

This kind of poetry can be understood, however, exactly in the context of the way Paleotti, Possevino and others filled out the programme.

We may think of this passage from John Donne:

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. Loyola had known about such disturbances; but <mark>ultimately he ascribed them to "the enemy"</mark>.

The champion of the Counter-Reformation thus could still provide dichotomic simplicity by means of projection and reification; the Baroque poet Donne, like the theoretician Possevino, had come to acknowledge the inherent quiet disorder of the human mind.

- 3. There is a striking contrast between Possevino's words and much of what we find with central representatives of the New Science
 - Bacon's belief that nature can be reduced to a finite number of forms;
 - Descartes' clear and self-evident truths;
 Descartes reproduces Loyola's dichotomy (by other means) separating "the passions of the soul" from the soul itself (essentially = thought)
 - the certainty of the geometric method;
 - the conviction of Boyle and others that the *experiment* can establish solid facts;
 - the faith of Descartes, Boyle, Leibniz and others that the mechanized thought of algebra may serve as a general model for the scientific and philosophical method.

General explanations

This contrast suggests *a first general explanation* of the absence of Baroque inspiration in the New Science:

The two cultural currents have radically different programmes.

Think of Galileo's vicious remarks about the Collegio-romano mathematician Orazio Grassi in *Il saggiatore*

(Grassi had dared to suppose a comet to be farther away than the moon and to point out that Galileo could not have performed his experiments too carefully):

It seems to me that I discern in Sarsi 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. At first Galileo just seems to postulate the incompetence of his opponent – cf. Benjamin Farrington (1938):

There is a phrase that has been much on people's lips in recent times to the effect that science is ethically neutral. It is, no doubt, possible to attach a meaning to this. But it is also surely true that with regard to one, at least, of the cardinal virtues science is not neutral: Science must be true.

However, certain turns in the assault hint at a more precise aim:

- Grassi plays with Baroque rhetoric and metaphors, though indicating that these are metaphors by explaining them;
- he further permits himself to refer to the testimony of ancient philosophers and even to such poets who – like Ovid and Lucrece – were "familiar with mathematics and natural philosophy".

For both reasons, Galileo can insinuate an identification of Grassi with *probabilism*: the doctrine (much favoured by the Jesuits) that "in matters of faith and morality, it suffices for the assurance of tranquillity of conscience to follow a plausible opinion"

"plausible" (*probabilis*): an opinion is shared by one of several (possibly discordant) recognized authorities.

The horrified Pascal: the consequence is that most humans will be innocent.

That horror may be one of the reasons Pascal and Arnauld created the concept of *quantified* probability: without quantification, the opposite *probabiliorist* doctrine – the *most* plausible opinion must be followed – is ultimately meaningless.

Beyond

- the acceptance/rejection of ambiguity
- the tie between Baroque culture and probabilism

another global conflict between the Baroque and the New Science of the mature 17th century can be pinpointed.

The Baroque was a "representative public sphere" – maybe the most striking deliberate construction of this type of public sphere before the advent of modern advertising.

In this respect there is evidentl<mark>y *no fundamental conflict with the roots of Moder*n science in courtly culture.</mark>

But from around 1615 the barycentre of the New Science moved toward circles of peers, say from the meetings in Mersenne's cell over Gresham College to the creation of the scientific academies.

Thereby, the ambience of the New Science became an exemplification of the other main type of "public sphere":

the one where "truth" is not displayed but results from discussion based on more or less well-defined shared principles between culturally qualified participants who, *with respect to the discussion,* are in principle peers.

Characteristic that Otto von Guericke's striking *displays* of the new truth were performed for the Emperor and for the Berlin court.

More representative is what Lorenzo Magalotti, secretary of the Florence Accademia del Cimento, wrote about Leopold, Medici prince and protector of the Academy. Leopold liked

to act as an Academician, and not as a Prince. He is content to play the second role only on occasions when there is a question of expense, generously supplying the needs of the Academy



This could be elaborated and modulated.

- On one hand, the integration of the <u>Académie des Sciences</u> in Colbert's state system had as one consequence the introduction of a hierarchy of *pensionnaires, associés* and *élèves*;
- on the other, printing gave new opportunities for the development of a republic of letters encompassing all of those who had received adequate education (in whatever way they had received it).

Indeed, the norm that knowledge should be made public (as knowledge that can be *understood*) is already expressed in the sixteenth century in as unanticipated places as John Dee's *Monas hieroglyphica* from 1564 and della Porta's *Magia naturalis* from 1591



Bird's-eye views are useful.

This one, to sum up, points to

- the contrast between the quest for simplicity and clear-cut answers on one hand and the acceptance of and even infatuation with ambiguity on the other;
- the roots of the New Science and the Baroque current in public spheres of discordant types

as plausible reasons why a Baroque influence on the New Science is difficult to discern.

However, it may also be useful to look at these general explanations through the lens of a particular example: a character deeply rooted in Baroque attitudes and at the same time participating in the unfolding of the New Science, or at least trying to do so.
Two formidable characters propose themselves: <mark>Athanasius Kircher</mark> and <mark>Juan</mark> Caramuel y Lobkowitz.

Kircher's activity ranges more widely in the natural-scientific field than Caramuel's;

Caramuel is more explicit as a theoretician of the Baroque.

I shall first concentrate on Caramuel, returning briefly to Kircher, and mention Rudbeck in an aside.

All three are polymaths, but polymathy is not an exclusive Baroque value: much of it, e.g. Alsted's encyclopediae, comes in the wake of Ramism, which in its love for dichotomic simplicity is at least as far removed from the Baroque as the New Science.

Caramuel's Baroque

He was born in Madrid in 1606, studied theology and entered the Cistercian Order at an early age; he died in 1682 after having been bishop, first of Campania behind Naples and afterwards of Vigevano close to Milan.

Many among his more than 70 volumes can be linked to the theory of the Baroque.

One is the *Defence of the age-old and universal doctrine, about probabilism.* Against *D. Prospero Fagnani's new, singular and implausible opinion*, about the doctrine that "in matters of faith and morality, it suffices for the assurance of tranquillity of conscience to follow a plausible opinion".

Further on in the initial abstract Caramuel states (in 1663, exactly one hundred years after the Trent council!) that

if the theologians will be allowed for another hundred years to constrain consciences with the same force as they have done these last hundred years, then the conversion of the infidels will be made very difficult, and also for the orthodox very great difficulties will most certainly have to be feared.

Pascal, convinced of the sinfulness of all men, protests time and again against Caramuel's tolerance in his *Lettres provinciales*, <mark>characterizing Caramuel as</mark> "Prince of the laxists" In **1635** Caramuel had published an *Easy and Clear Explanation of Steganography,* or of the Key of the German Solomon, Ioannes Trithemius

Since Trithemius introduced it in the early 16th century, "steganography" (the art of concealed writing, cryptography) was in odour of cabbala and black magic (for which reason Trithemius's book was only printed a hundred years later).

Caramuel (as later Kircher) exonerated it of all dependency on demonic pact or superstition, understanding the cryptographic technique instead as a way to uncover the secrets of the mind through connotations.

In *Cabala, hoc est, secretior interpretatio Sacrae Paginae* (never published) Caramuel did the same to cabala itself, using it to find hidden meanings in the Scripture.

His *Metametrica*, he tells, was nothing but this reinterpretation of cabala, given this new name because of the notoriety of the old one.

This *Metametrica* from 1663 is an extensive treatment of poetical techniques.

Here he phrases the programme that

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

and praises the logogriph as an

enigmatic song, which digs many significations from the same name, reading backwards, taking away letters or adding others.

If anybody, Caramuel is thus an exponent for Baroque ambiguity, for the use of connotative appeals rather than explicit messages.

The word "audacious" (*audax*) recurs in several of his titles

- a Grammatica audax is the "praecursor logicus" to his Theologia rationalis (1554–55)
- a Mathesis audax from 1644 deals with combinatorics (that is, we may observe, the mathematics of the anagram and logogrif), meant to replace and outdo Aristotle's organon as a universal key to all sciences
 The full title is Mathesis audax rationalem, naturalem, supernaturalem, divinamque sapientiam arithmeticis, geometricis, catoptricis, staticis, dioptricis, astronomicis, musicis, chronicis, et architectonicis fundamentis substruens exponensque.

Even Caramuel's understanding of etymology is, as we shall see, "audacious": It is not necessarily meant to reveal the true historical origin of words but rather, like the logogriph, to reveal concealed possible meanings. Similarly, Rudbeck explains in the *Atlantica* (an attempt to show that all famous royal houses etc. have their origin in Sweden) that

Ornaments and paintings do not please all in like measure, for as one person wants green the other wants grey, when the one 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.

Etymologies, different from written sources (uncertain) and geographical facts (certain), are thus a domain that allows audacious subjective choice and where "the least important thing is whether what is written [...] is true".

Caramuel the mathematician

After 1663, the Jansenists and the Dominican probabiliorists got the better of Caramuel, and he was no longer allowed to persist in moral and theological tolerance.

Instead he published two huge volumes in 1670 about mathematics.

The *Mathesis biceps* is divided into "old mathematics" and "new mathematics", running over more than 1800 folio pages.



Juan Vernet tells in *Dictionary of Scientific Biography* about this work (mentioning no other) that

although it contains no sensational discovery, [it] presents some original contributions to the field of mathematics. In it is expounded the general principle of the numbering systems of base *n* (illustrated by the values 2, 3, ..., 10, 12, and 60), pointing out that some of these might be of greater use than the decimal. He also proposed a new approximation (although he did not say so) for trisecting an angle. Caramuel developed a system of logarithms of which the base is 10⁹, the logarithm of 10¹⁰ is 0, and the logarithm of 1 is 10. Thus, his logarithms are the complements of the Briggsian logarithms to the base 10 and therefore do not have to use negative characteristics in trigonometric calculations. In these particulars Caramuel's logarithms prefigure cologarithms, but he was not understood by his contemporaries; some, such as P. Zaragoza, raised strenuous objections.

Caramuel's mathematics seems as easily separable from his Baroque poetics as Newton's *Principia* from his "chronology of ancient kingdoms"

This, however, is <mark>a mistake.</mark>

First: what Vernet sees as a presentation of "the general principle of the numbering systems of base *n*" is a "preliminary meditation" before the treatment of arithmetic (proper).

It answers the question

whether arithmetic be one, or several? If several, which they may be? And how do they differ from each other? Are they practical, or speculative? And are they necessary?

Caramuel's intention is not to produce a "general principle" but exactly the opposite. He describes place value systems with base 2, 3, 4, 5, 6, 7, 8, 9, 10, 12 and 60 and shows how to calculate in base 2, 3 and 4.

He concludes that

Firstly, it is thus established *that several arithmetics are possible*, *which differ from each other:* indeed, as there are various languages in the world, so they can be dissimilar, and varied with respect to the first return of the unit. I intend, 2, 3, 4, etc., as we have shown above.

Secondly, it is established that *all these arithmetics are analogous*: indeed, as all languages agree analogically in their flow, similarly, or certainly even more strictly, the arithmetics agree. [...].

Thirdly, it is established that before the operation of the mind there is neither number not arithmetic. Truly, numbers are entities produced by the intellect: and that the return of the same numbers depends on human free will; and that these go back to the beginning at so many, and neither by more nor fewer units is because it pleased those who first fashioned arithmetic thus and not otherwise. [...].

In the next paragraph, Caramuel emphasizes that numbers are not chimerical figments of the mind but *formed* by the mind, and that *after* the operation of the mind they truly exist in things. His "relativism" is Einsteinian, allowing translation, not postmodern in Feyerabend-Latour style.

Caramuel was the first to publish about different place value systems and describe algorithms for calculating with them.

The metamathematical stance is even more original, too original indeed to the taste of mathematicians (and to Vernet): even non-Euclidean geometries were only accepted broadly when Felix Klein had reduced even this pluralism to a single "general principle".

Subjective choice turns up even in places where we would expect Caramuel's choice to be anything but free:

Repeatedly he returns to the <mark>choice between the Copernican, the Tychonic and the Ptolemaic world syste</mark>m

As we should expect from a Catholic bishop in 1670 he <mark>rejects the Copernican option.</mark>

His formulations, however, are not as we would expect.

He does not say that this system is contrary to Sacred Scripture but that the cardinals have declared it to be contrary to Sacred Scripture

(as indeed they had; the statement is preceded by a list of "famous mathematicians" – Galileo, Kepler and others – who support the Copernican system).

Caramuel's own opinion is stated in phrases like <mark>"for me, the earth stands still"</mark> or

We have no need for that which the Church has condemned. When hence the Copernican system has been rejected, the two others remain in court. The Ptolemaic system is implausible [*improbabile*]: Nobody can indeed deny that Venus and Mercury move around the sun. Thus the Tychonic system stands.

Algebra!

Caramuel wrote long after Cardano, Bombelli, Viète and Descartes, and it therefore seems adequate that algebra is treated on 108 folio pages.

What is striking is that these pages belong to the first volume, "ancient mathematics".

This location turns to be well-founded. *Nothing* of what these four authors had done has indeed left the least trace in Caramuel's algebra.

This does not mean that Caramuel just explains or repeats what can be found in algebraic writings from the earlier Renaissance or the Middle Ages. As far as I know, *no* precursor ever dealt with the material as does Caramuel. His basic idea – a *free choice* if any – is that algebra or "abstract proportion" is an extension of the "false position" and the rule of three. **"False position"** (may be "simple" or "double"):

A number, to which $1/_7$ of itself is added, gives 19.

– "simple": we make a convenient but probably false guess – for instance, that the number is 7. Adding its 1/7 gives us 8 – but we should have 19/8 as much. Therefore, our guess should also be multiplied by 19/8.

- "Double": we make two guesses (for instance, 7 and 21), and find the result as a mean, weighed in inverse proportion to the two resulting errors (the principle of alligation).

"Rule of three": 3 sacks of flower cost 17 shillings, what is the price of 4 sacks? The rule, as it is formulated in late medieval abbacus books, prescribes that we multiply [the counterpart of] the things we want to find (that is, 4, namely 4 pounds) but the magnitude which is not of the same kind (17, namely shillings) and divide by the third magnitude (3, pounds).

Both methods are *alternatives* to algebra as we know it from the medieval treatises rather than fundaments for it.

For this reason, **Caramuel's algebra never goes beyond the first degree**, even though his presentation of algebraic symbolic notations suggests a notation for higher powers.

All preceding algebras had the second degree as their core. Caramuel's choice is truly unique.

I shall discuss only a few aspects of Caramuel's idiosyncratic algebra.

At first comes a philosophical deliberation whether it is possible to derive true conclusions with necessity from false premises.

This deliberation is necessary precisely because of the <mark>identification of algebra with the "false position".</mark>

Caramuel rambles widely. He moves through

- the schemes of Aristotelian logic (not least of course *modus tollens*, the "indirect proof" whose schematic figure called *barocco* may indeed have given rise to the nickname which the Enlightenment gave to seventeenthcentury art);
- the fictions of legal thought: "Titius has sold an acre of land to Marius ..."
- *theorica planetarum* with its falsely assumed epicycles and crystal spheres;
- l<mark>ogarithms</mark>;
- the **indirect proofs** of mathematics;
- and finally the false position.

Caramuel's conclusion is a denial of the possibility of deriving true conclusions with necessity from false premises.

Caramuel, like Farrington, thinks that "science must be true", his steganography and logogriphs should not be seen as a rejection of the demand for truth.

But as Paleotti's way towards piety, the path toward truth may be indirect, poetical rather than through explicitly argued discourse.

This is clearly exemplified in what follows: an etymological investigation of the origin of the names of algebra: *algebra*, *cossa* and *almucabala*.

First comes a philological discussion of the proposal to derive *algebra* from the name Geber, at the level of 17th-c. standard philology at its best.

Caramuel objects that Geber Hispanus (Jābir ibn Aflah) must have lived around the 12th century, too late.

But then Caramuel goes on, at first with a borrowing from Alsted's *Encyclopaedia*: Algebra is an arabic word, which means the doctrine of the excellent man: AL, indeed, is the article: GEBER means Man: and it is often a title of honour, as with us Master, or Doctor. Today this book is much venerated among the erudite nations of the Orient, and by the Indians who are very fond of this art it is called Aliabra, or Alboret, since they do not know the proper name of its creator. Certainly $\exists \exists \lambda$, GABAR, in Arabic is restored. And as the article is $\exists \aleph$, AL, prefixed, the restoration of arithmetic was $\aleph \exists \exists \lambda \neg \exists \aleph$.

But why do we call the same science *cossic*, and the special numbers which it makes use of, *cossic numbers*? In Tome 2, book 14, chapter 4, § 1 in Alsted: Moreover, Algebra was called the art of res, and census by certain Latin writers; as with Regiomontanus; by the Italians (read, by the Spaniards) Arte de la cosa, from which Cossa. Christoph Rudolph, excellent master of this art, considers that the rule is called Cossic, as Art of things, because it serves to solve questions about hidden things: after the manner in which arithmetic books usually express themselves in all problems, We lay down a thing. Further, by certain Greeks Algebra was called Analytica. *They also,* etc. [...] And there are in Europe two current names, **Regula di tre** [the rule of three], and Arte de la Cosa, the former Italian, the latter Spanish, which clearly indicates how much these two nations have promoted, adorned and made illustrious arithmetic.

Further, if you do not want to favour the Spaniards, you shall say that the term *Cossa* comes from the Hebrews or the Arabs to the Greeks and the Latins. Indeed $\neg \bigcirc \neg$, *Casar*, with the Saracens is *to Break* [*Frangere*], and therefore should mean the science which considers broken numbers [i.e., fractions]. Add to this that one may derive an etymology from the roots $\aleph \lor \bigcirc$, QAZAR, *was Brief*: indeed, this science is a kind of arithmetic which is fit for judging, and most sure in matters concerned with numbers. An indication that it solves with utmost security and concision difficulties which ordinary arithmetic is hardly able to solve when moved in roundabout ways and labyrinths.

Johannes Geysius explains the word differently. In *Book* 1 *on the CoB*, chapter 1, he says, COSSA *comes from* $\exists \forall \exists, CASA, that is, Weaved; it teaches$ *indeed to find a number which has been hidden*.*Etc.*This*indeed*I do not understand, since "to weave" [*texere*] is not "to reveal" [*detexere*]. Say thus that this ability was named from weaving because it disentangles numbers which have been woven together and intertwined; so that the denomination refers not to the science but to the object.

In Greek it can also be called KO Σ IKH, since KO Σ IMBO Σ is a *Knot*. And actually, all problems which are treated by this science are knots which you cannot solve if not by breaking (dividing unity). And also, if anybody is audacious, from *Cos*, a Latin word, *Cossica* is almost as saying *Cotica*. The mind actually needs a whetstone [*cos*] in order to be sharpened, and this science sharpens the mind, which is often dulled by badly digested methods. But even the small worms which bore through the hardest tablets are called *Cossi* by the writers on natural history. Also, if anybody is audacious, the name may be drawn from here. Indeed, if the multiplication table is easy and can be penetrated by any mind, others are hard, and cannot be penetrated if not by learning the *Cossic* art.

Further, it follows from Johannes Geysius's *Book* 1 on the CoB, chapter 4 No. 4 that CoB and Algebra are the same thing. There he says, It is also called ALMUCABALA, that is, Hidden tradition; and also ALGEBRA, that is, Magisterial Art. Etc. And Alsted, who in Tome 2 book 14 § 1 says, It is told that there was one remarkable Mathematician, who wrote down his art in Syriac language and sent it to Alexander the Great, and called it ALMUCABALA, that is, book on hidden things (this Art, indeed, teaches how to find a hidden number), the doctrine of which others preferred to call ALGEBRA. None of them expresses the precise meaning of the word. Indeed, コラコア is *Tradition*, from the root フコア QABAL, to transmit. Since they would not divulge it, they did not transmit it in writing but orally to disciples. DITIMAQABALIM are *Cabalists*, and when the article is added it could be called AL-MUCABALA, not in Syriac but in Arabic.

ENAPIΘMOΣ is said about the one who is appreciated, a distinguished and extraordinary man: from which ENAPIΘMIKH, some noble and distinguished kind of arithmetic, which is appreciated by learned men.

But one may also call this thing METAPIOMIKH which has gone beyond the measure of common arithmetic and traverses the fields that lay beyond it. Obviously Caramuel does not believe that the etymologies from *Casar* onwards are historical truth:

They are propounded for the case "you do not want to favour the Spaniards";

some are "audacious";

repeatedly two alternative explanations are combined into one figure (as *qaza* and *qazar*).

As the steganography and the logogriph, these etymologies are meant through poetical play to dig out – *or rather display* – aspects of the nature of algebra.

That these aspects are indeed prior to the etymologies can be seen for instance from the example KO Σ IKH/ $\kappa o \sigma \omega \beta o \varsigma$: only the one who already knows that he wants to get to broken numbers (that is, to transcend the Greek concept of number as a plurality of units) will find it in *knot*.

The Reception

Caramuel's *Mathesis biceps* is thus soaked with ambiguous and poetical Baroque subjectivity – so far removed from the Counter-reformation "constraint of consciences" that only familiarity with the mediating process allows us to discern the connection.

Caramuel's Baroque is no external aspect, no mere decoration, as Grassi's poetical references in the treatise about the comets: it inspires the investigation of the "plurality of arithmetics" and allows the understanding of algebra as an abstract version of the false position.

understanding of ungebra as an abstract version of the faise position.

Even when writing about mathematics, Caramuel remains a Baroque mind.

Was he a mathematician all the same?

The creators of the New Science appear to have nourished some doubts;

as Vernet points out, they did not understand the new mathematical ideas contained in the *mathesis biceps* (Leibniz had to reinvent the place-value system), and the rest did not interest them.

If we look for references to Caramuel in the extensive correspondence of Oldenburg, the secretary of the Royal Society, we do not find much.

In 1668 John Collins lists his *Solis et artis adulteria* as one of those books in a catalogue "which I doe not much desire unless cheape";

in 1669 he asks Oldenburg "how he approoves the treatises of John Caramuel Lobkowitz Intituled Ingeniorum crux et Mathesis audax".

Oldenburg forwards the question to René-François de Sluse, who answers that I saw the *Mathesis audax* and *Sublimium ingeniorum crux* very many years ago, but saw them only, nor does any memory of them remain. In 1670 Sluse offers to get hold of the *Mathesis biceps* when it becomes available.

In the meantime, Oldenburg has received a letter from François Vernon referring to

a great Vast Bulke of Caramuel, Able to fill a Library. His Mathesis biceps, speculative & Practicall [*sic*] 2 vol in Folio. His Calamus 2 volumes more [i.e., *Metametrica*] & whc is worse hee is [not] contented with the loade hee hath laid on the world already. but he promiseth to Plague it wth I doe no know how many volumes more.

In consequence, Oldenburg answers (vol. VII, p. 368) that

As for the two ample volumes of Caramuel Lobkowitz, we understand them to be damned with faint praise, which has cooled our desire to see them. Sluse, on his part, concludes (vol. VII, p. 484) after getting hold of the volumes that

I have looked through Caramuel's farrago, and indeed, to speak kindly, its utility does not seem proportionate to its bulk.

This is all – neither much nor very positive.

Historical or historiographical problem?

Examination of <mark>Kircher's works and their reception</mark> would lead to similar results.

Most of his works about nature deal with issues and objects for which it was less easy to judge the validity of new results and proposals than in the case of mathematics

– magnetism, the subterranean world, applied acoustics –

so the rejection is less absolute.

Yet the difference is not significant – when Kircher approached nature as a *Gesamtkunstwerk* or *theatrum* (his word) it was difficult to find a perspective which was theoretically fruitful or seen as such by the representatives of the New Science.



In so far we may say that the absence of a Baroque impact on the New Science is a fact of history, no historiographical blind spot.

Works too close to the Baroque emphasis on ambiguity and poetico-connotative understanding were too far removed from the sensibility of the New Science to gain much influence.

When they offered new answers, these were to questions which seemed outdated or irrelevant, or they concerned matters that were too complex to allow the answers to be convincing.

However, once work with the Baroque prototypes has opened our eyes to characteristic Baroque features, we may find such features elsewhere though as a rule not together.

Three sketchy examples:

 Scott Mandelbrote distinguishes two kinds of natural theology in 17th-c. England:

the "Wilkins-Boyle" type which

stressed the importance of the providential ordering of nature and the consequent lawful operation of the universe as a proof of divine superintendence and of the power of the divine will

and that of the Cambridge Platonists, which based its argument on

appeal to the wondrous activity found in nature, of which regularity was only ever a part, and which required the constant, creative involvement of a hierarchy of spiritual agents

and which

was ultimately weakened by its association with credulity and with discredited attempts to prove that spiritual agents could be observed at work in the world.

The agreement in attitude of the latter group with the Kircher we know for instance from the *Musurgia universalis* is not perfect, nor is it however totally absent. The reasons for rejection are also fairly alike.

2. The title pages and frontispieces of scientific printed works of the epoch, as discussed by Volker Remmert.

The point is **not** that these **look very much like other visual art from the epoch**, and thus as "Baroque"; this could hardly be otherwise.

Significant is that they served to carry a message by indirect, metaphorical means about the trustworthiness and legitimacy of the book under the frontispiece.

However, the frontispiece-message was not only distinct from the technical argument of the book, which it would indeed be hard to translate into emblematic pictures

It was also largely directed at a different audience, an audience that was hardly able to follow the technical discourse.

The text of books was thus directed at the argument-based public sphere of the incipient "republic of letters"; the frontispieces were directed at a distinct, representative public sphere.



9.15. Jonas Moore, New Systeme of the Mathematicks (London, 1681)
3. Finally, should the tenacious dedication of certain late-17th- and earlyeighteenth-century *virtuosi* to the study of insects, worms and microscopic animals irrespective of the scandalized antagonism of galant society and writers like La Bruyère and Addison be seen as a symptom of Baroque obsession with everything proteic?

If such suggestions of Baroque presence are taken into account, we may conclude that the total absence of the Baroque from the historiography of seventeenth-century science is also to some extent a historiographical artefact. But this is a different story which I shall not pursue.

A third story – no less important, perhaps, but which I shall not take up even sketchily – is the *modernity* of the Baroque.

Not, of course, in relation to modern science,

- but as the starting point for an understanding of the nature and tasks of poetry that was to unfold in the aesthetic theories of the twentieth century
- and (less flattering perhaps for the seventeenth century but quite to the point if we think of the initial intertwinement of the Baroque with Counterreformation and courtly propaganda) in relation to the contemporary calculated use of emotion, ambiguity and indirect messages in the advertisement industry.

What makes us buy, believe – and even vote – the way we do?



HOW

Many of us are being influenced and manipulated in the patterns of our everyday lives

People's desires, needs and drives are probed in order to find their points of vulnerability

The probers aim to influence the state of our minds and channel our behavior as citizens

Television conditions children to be loyal enthusiasts of a product whether they are old enough to consume it or not

Both parties merchandise their candidates and issues using the same methods that business has developed to sell goods

Vance Packard

With an Introduction by Mark Crispin Miller