

FRANCESCO ALGAROTTI'S WORLDLY NEWTONIANISM

Maria Teresa Marcialis

Università di Cagliari, Istituto di Filosofia

Towards the end of 1737, Francesco Algarotti's Newtonianesimo per le dame, ovvero Dialoghi sopra la luce e i colori is published in Milan in a semi-clandestine edition and with Naples falsely indicated as the place of publication. Algarotti was a student of Eustachio Manfredi and Francesco Maria Zanotti, an experimenter of varying success with the Newtonian prism, a refuter of Rizzetti at the Istituto delle Scienze in Bologna, companion and correspondent of Voltaire and Madame de Châtelet, Maupertuis' friend and a fellow in the Royal Society: he thus seems to possess all the qualifications for transposing Newtonian physics from technical to vaster cultural circles: that of drawing-rooms, ladies and a non specialized audience educated outside the Academies (1). This operation has, as is known, an illustrious precedent: the Entretiens sur la pluralité des mondes in which Fontenelle in 1686 taught countesses and honnêtes hommes vortex physics. And Algarotti dedicates his work (2) to Fontenelle, present in the framework, the didactic metaphor and the nearly textual references.

As is known, the Entretiens constitute a model of high scientific divulgation in seventeenth and eighteenth century Europe. This is true not only due to their perfect transposition of technical language into a so-called "daily" language but above all for the "philosophical" consequences they draw from vortex physics, the axiological implications they bring to light and for the emotional aspects they revealed, in short, for their transformation of a technical discipline into a conception of the world. The link established between vortex physics and the Copernican hypothesis became exaltation of the infinity of the universe; the connection between mechanistic clarity and natural legality meant both liberation from prejudice and superstition and elimination of stable structures and pre-established hierarchies. Cartesian physics has

nourished the vision of a world undergoing continual change and transformation akin to less scientific images of heterodox, libertine reality.

Newtonianesimo per le dame attempts this transformation of technical content into a world conception for the Italian audience, no longer beginning from conjectural but rather experimental physics and no longer revealing the implications of a series of hypothetical propositions but, as Algarotti says, of the "truth" (3) demonstrated by Newton. In fact, the comparison between Descartes and Newton occurs not only on the level of contrasts between the logical-epistemologic models directing the construction of their respective types of physics, but also on the level of the premises on which these types of physics are based, the values they develop and the practical consequences they produce. Algarotti's work, whose success is demonstrated by its many translations, will be considerably less brilliant than Fontenelle's. On the formal level it will be spoiled by a type of discordance between drawing-room simpering and technical meticulousness in describing his optical experiments, and on the level of content it will not succeed in bringing out that perfect permeation between technical and "philosophical" levels which had assured the success of the Entretiens. Other contingent reasons also certainly contributed to this imbalance. The Italian audience to whom Newtonianesimo per le dame is destined is considerably more conditioned than the French audience (4) and, for various reasons (the audacity of Copernicanism professed in a country where the Copernican hypothesis is still in the Index, the germs of materialism undoubtedly present (5), sustained gnosiological relativism or external reasons such as the author's Masonic faith (6)), the work is placed in the Index in 1739. Algarotti will adapt it several times: in 1739, 1746, 1750 and 1752 (7). But the different editions, although giving the work greater formal elegance, will affect its incisiveness, making it gradually more neutral and less committed and therefore more aseptic on the level of so-called "philosophical" contents. Ettore Bonora will define the last edition a "work still behind the real spirit of Enlightenment" (8). However, in spite of these limitations (or perhaps because of

them), it may not be completely irrelevant to re-read this attempt at divulging Newtonian physics in the "elevated" sense stated, and note the modifications in tone and commitment to be found by comparing at least two editions: the first in 1737 and the last in 1752. From this comparison, we can perhaps obtain a many-faceted image of Newtonian "philosophy" and Newton himself, very different from other Newtonian images traced in eighteenth century Italy, as for example Celestino Galiani's in Epistula de gravitate et cartesianis vorticibus or Genovesi's Disputatio Physico-Historica.

The aspect of Newtonian physics Algarotti favours, although varying emphasis, in all editions of Dialoghi, is experimentalism and not the mathematical theory supporting that experimentalism. This choice is certainly based on fortuitous motivations connected to the didactic task Algarotti's work sets itself: the marquis to be indoctrinated does not know mathematics and in any case it is better to speak in images than in theories (9) to ladies who prefer to feel rather than to know. But there are other less incidental motives to justify this choice, motives which in any case give Algarotti's Newton a specific, singular qualification. We previously alluded to Algarotti's scientific formation at the Istituto delle Scienze in Bologna; we must recall the experimentalist tradition of that Institute, whose professors, beginning from the second half of the seventeenth century, had been Galileo's pupils. Marcello Malpighi pointed out the difficulties and problems of the experimental technique when he said:

Observation is not so easy as others think: great knowledge is required to direct the method, abundant observations to see the chain and thread connecting the whole, a dispassionate mind, fine judgement (10)

And Eustachio Manfredi, under whose direction Algarotti began his own experimental activity, was an experimenter, albeit in a neutral, instrumental way. In addition, as has recently been demonstrated, Newtonianism enters Italy (this observation is especially valid for the Bolognese environment but much less so for the South) especially through the Latin edition of the Optiks

which "prepared the way for the Principia Mathematica"(11). And the Optiks, as we know, can be considered the manifest of Newtonian experimentalism. Algarotti does not shun this preference; thus, although not entirely unfamiliar with the Principia, in his Dialoghi he refers almost exclusively to the Optice(12). Thus motives of school and environment lead our author towards the experimentalist Newton. In any case, this does not render his choice meaningless. While permitting those links between Newton and Galileo so frequent in Algarotti's work, on one hand it retrenches the scientific meaning of Newtonian synthesis and on the other makes unexpected "philosophical" approaches and developments possible. The Principia Mathematica had confirmed seventeenth-century scientific philosophy, perfectly meeting the demands expressed by Galileo, Kepler, Descartes and Huygens; the discovery of the fundamental principles of universal physics had been made possible by the coherent system of mathematical theory and not only by the use of algebraic and infinitesimal calculus and the singling out of the mathematical relationships pursued by Newton. Unbalancing the Newtonian operation in the sense of experimentation meant not being fully conscious of the unification of the celestial and terrestrial worlds effected by Newton. In Newtonianesimo per le dame there are evident allusions to the "genius" of the "geometer" Newton, discoverer of what was infinitely small, "who overturns (.....) infinitely all the absolute ideas of large and small" (13). And Newton is referred to as the greatest mathematician who ever existed, so great that "anything to do with mathematics sprang from his hands" (pp.170-171). And it is also true that the Dialoghi sopra l'Optica Newtoniana state that "Newton subdued planetary irregularity with the subtlest geometry" and that "Newtonianism is the mathematical code of nature's laws"(14). It is evident that Algarotti cannot totally refuse mathematics in explaining attraction to the marquis as he must at least enunciate the law of the inverse of the square of distances. Newton is however a great physicist above all because "only one of his experiments advances our knowledge more than the sum of all the most magnificent, ingenious systems which existed before him"(p.154). He is the one who "devices and varies

experiences" so that "he was not lacking in the most fertile, poetic imagination for invention, let us say on every page, new ideas which, although differing from one another, come together as proof of the same thing" (p.203). And he is great because, as will be more soberly stated in the Dialoghi in 1752, he was capable of observing those unimportant phenomena which permitted him to verify the law of the refrangibility of rays. Algarotti's sensitivity (this is the appropriate word) to experimental practice, his attention to the inventiveness linked to devising ever-new experiments, his stress on diligence in trying and trying again, his concern about instrument efficiency and his awareness of the margin of chance linked to experimental success become the exaltation of a Newton "revealer of truth" through observation and diligence. However, Newton does not appear to be the maker of that perfectly balanced, cohesive universe; nor does he seem the theoretician of that epistemological model of unification of phenomena under a single principle which, as Cassirer among others demonstrated, would have had such a large following in the culture of Enlightenment. Therefore the affirmation relative to the unifying function of attraction ("it is the key to all philosophy and the great motor of nature, this mysterious, universal force discovered and calculated by Mr. Newton, set before philosophers by the great Bacon of Verulam and sung in splendour by the English Homer" (p.229)) in Newtonianesimo per le dame or the remarks on the uniqueness of the force "which produces effects which still appear or appeared even to widely-differing philosophers" in the Dialoghi (1752) are lost in Algarotti's work or, in any case, rather than demonstrating awareness of the mathematical base from which they sprang, seem somehow to return to then-obsolete metaphysical formulas.

But, as we previously indicated, the imbalance in Newtonian physics in an experimental sense, while somehow involving a diminution (if not a misunderstanding) of Newton the scientist, permits a very broad interpretation of Newtonianism as a conception of the world. Recent studies on Italian Newtonianism have revealed the dissociation occurring in many Italian scientists between

adherence to Newtonian mathematics and disinterest in Newtonian "philosophy". Mathematics is understood by many (here too with a particularly incorrect understanding of all of Newtonian physics) as mere technical apparatus which can peacefully co-exist with any conception of the world. Algarotti seems to follow this conception, but with opposite results; for him, giving little importance to mathematics means relinquishing the neutral part of Newtonian physics, while stressing experimentalism means opening new perspectives. One could certainly use an experimentalistic vision, as Eustachio Manfredi did, in a purely instrumental way without attributing any philosophical or ideological meaning to it; his French and English experiences, his acquaintance with Voltaire, and Fontenelle's example keep Algarotti from this approach and give his experimentalism that innovative meaning which will perhaps be one of the cause of the listing of Newtonianesimo per le dame in the Index.

The experimentalism Algarotti speaks of is certainly a work method. He can define it by echoing all those commonplaces of eighteenth-century empiricism: the refusal of systems built on hypotheses and the appeal to facts, giving up research on causes in favour of effects, shifting the focus of investigation from why to how, passing from guessing to observing. In turn, violent polemics return regarding the Cartesians, imaginative, dogmatic builders of inconsistent systematic structures; in contrast, an appeal to Galilean tradition arises with the establishment of a line of continuity between Galileo and Newton (16). But Algarotti's work does not only consist of the simple contrast between two research methods, the Cartesian and Newtonian, the sterile and the fertile. Experimentalism implies a sensistic theory of knowledge but involves above all liberation from prejudice, elimination of superstition and a broadening of human action. Refer to the long eulogy of experimental philosophy contained in Dialogo IV and suppressed in the other editions. Comparing physicists to scholars who attempt to reconstruct an ancient text on the basis of detached fragments, Algarotti says:

The original authentic manuscripts of nature are

observations and experiences which, overturning as they have so many fine systems, always teach us to think of ourselves as little as possible (p.147)

For example, the discovery that the moon does not exercise evil influences on man is due to these manuscripts and observations; fear of comets, pillars of fire, showers of blood and will o' the wisps was cured by observations: "All these indications of celestial anger" says the marquise, "do not cause the loss of even half an hour of sleep except to those who will always be common people and to whom someone will always render these beliefs valid" (pp.150-51).

Observations also led to the destruction of the insuperable obstacles to human knowledge: credulity, love of marvels and negligence. Observations eliminated the major superstition: veneration of the ancients. In this way, experimentalism becomes antitraditionalism with all it implies, but similarly it too leads to even more dangerous consequences.

No system—says Algarotti—seems perhaps to have firmer foundations than the one saying that wings were made for flying and legs for walking; however, through observations, insects have been found with large, beautiful wings never used for flying, and similarly one was found with legs located like the others, formed in the same way and with similar proportions, which almost always walks on his back with his legs in the air, as if one did not realize he had wings or the other legs (p.148).

The finalistic conception of nature and along with it the providentialistic vision of the universe are thus led to a fundamental crisis in the elimination of another topos in the finalistic tradition: antropocentrism. In fact, it is punctually eroded in the pages of Newtonianesimo (17).

Newton is rendered responsible for these innovations more than for the confirmation of Copernican theory, professed openly here but obviously presented

previously as a conquest of vortex physics. This was not a totally correct operation in the philological sense if one thinks of the finalistic aspects of Newtonian physics in Bentley or Clarke (or even in Voltaire) and which Algarotti himself (but we shall see in what sense) will admit in the Dialoghi in 1752. This is an operation which evidently portrays the exact opposite of the image of Newton given in the Boyle Lectures. But it is obviously not opportune to reveal now philological mistakes or interpretative misunderstandings; on the other hand, it is worthwhile to stress more fully the meaning of Algarotti's interpretations of Newton. More than inspired by Locke's experimentalism (Locke is obviously never mentioned; Berkeley is, regarding the vision theory and the Molineux question (18)), it is inspired by Fontenelle's "modern", libertine innovations (Cartesian but empiricist) in the Entretiens and the Digression sur les Anciens et les Modernes.

As we know, Voltaire's judgement regarding Newtonianesimo per le dame was, in least in private, restrictive:

Le peu que je lis de son livre—he wrote to Thierot (19)
 —en courant me confirme dans mon opinion. C'est presque en
 italien ce que les mondes sont en français. L'air de copie
 domine trop et le grand mal c'est qu'il a beaucoup d'esprit
 inutile.

But imitation, "air de copie", goes well beyond the worldly tone and sometimes servile repetition of motifs and remarks. It consists instead of adopting the general (and ideological) background in which to insert physics and limiting itself to the substitution of vortex physics by that of attraction (20). Even more, the same theoretical conception of nature sustaining the exposition of Newtonian physics clearly echoes the theory of nature as understood in the Entretiens: Nature is economical (Dialogo V even states "newtonian nature is more economical than Cartesian nature (p.219)); Nature is magnificent, rich and varied (p.219, pp.63-64); Nature is uniform and can be understood by applying the criterion of analogy. The law of the economy and uniformity of nature (if not its

variety and natural magnificence) are, as we know, criteria found in the Regulae Philosophandi of Newtonian Principia (besides, obviously, in all pre-newtonian tradition, from Ockham to the early Malebranche); in Newtonianesimo per le dame these criteria are not regulae but maintain the metaphysical substance they had, in spite of everything, in Fontenelle's Entretiens.

In the midst of this operation and while Copernicus, Galileo Kepler, Descartes and Fontenelle were still in the Index, the Dialoghi could not pass unobserved. Such a profession of faith in the "moderns" and their doctrines could only assure Algarotti's work a similar fate. The need to neutralize this sentence and above all to render Newton's "truth" available to the Italian audience will force Algarotti, as we already said, to revise his work several times. We have no critical edition of the Dialoghi which allows us to verify the modifications in the different versions, nor is it our task to record all these changes or point out all the changes in tone occurring between 1737 and 1752. It is perhaps sufficient to say that Algarotti is shaping his work and progressively eliminating the most compromising inflections. Thus, besides the praise of experimentalism and the profession of Copernican faith, the long discussion on the born blind and the correspondent emphasis given to touch as an organ of knowledge of the external world disappear; the references to dangerous authors like Swift, Ruggero and Francis Bacon and the harsh charges against Scholasticism disappear; the dedication to Fontenelle vanishes and is replaced by that to Frederick II of Prussia; the relationship between Newton and France is articulated differently to give space to Maupertuis and mention Voltaire (21). But we are interested here in seeing how this polishing operation reflected on Newton and how that "libertine" image of him which appeared in Newtonianesimo per le dame is modified. We must immediately say that if the experimentalist stress remains, with all the anti-Cartesian and antivortex inflections it involves, it has however lost its liberatory function and its consequent antitraditionalisms and antifinalisms. Other aspects of Newtonian "philosophy" emerge, however, more consistent with Bolognese tradition and in a

certain sense more neutral:the distinct separation between physics and metaphysics on one hand and interest in the practical applications of the theory on the other.

Thus, for example, in Dialogo IV,dealing with attraction, which is still interpreted as a " property of matter" and defenced from the accusations of occultism addressed to it by mostly French detractors,Algarotti in 1752 reads Newton's hypothesis on the heavens as a simple,useful expedient for the diffusion of physics:

(Newton) - he says- somewhere said that attraction was perhaps an effect of impulsion of collision, as of unbelievably thin matter,an extremely tenous vapour which was by chance in every part of the universe, a sign that he wanted to, as we say,but himself in someone else's place; he felt it was not necessary to contradict common opinion. To make way for truth it is to his advantage to use some artifice (p.94)

In fact, as stated elsewhere (22),Newton always maintained that it was impossible for philosophers to arrive at the essences of bodies.

And in Dialogo IV, he thus interpretes Newtonian finalistic tendencies:

It is true that Newton did not demonstrate any reluctance to reason about final causes;but it is also true he often used the saying: physicist, beware of metaphysics;knowing well how far we were, with our limited visions, from being able to understand the reasons why things must be this rather than that way (p.139)

In this way,the link between experimentalism and antifinalism, which in Newtonianesimo had authorized a mechanistic, antiprovidentialistic vision of Newton,is blunted in the accentuation of the separation of physics and metaphysics and in the exhortation to caution in research.The author of the Scholium Generale is thus the physicist (this really in consistency with Locke)

clearly aware of the limits of human knowledge and experience. This it is not by chance that, among the readers of Newtonian physics, Algarotti's attention is principally directed towards that Musschenbroek who, unique among those referred to in the first edition (23), will also be praised in the final one. Musschenbroek, so superior that "he flies above the others like an eagle", is not only the philosopher "so famous in our times for experimental art" (p.114), nor is he only the prototype of the man who chose freedom, even in philosophy. Mussechenbroek represents that "positive", experimental Newtonianism, tending to the erosion of hypotheses, which somehow constitute the partner to Bentley's as well as Toland's Newtonianism. And in Elementa Physicae (I,40), Musschenbroek said regarding corpuscular theory:

Idcirco, qui ex Metaphysica probare nituntur omnia corpora
necessario aliqua nota esse distincta, doctrina cum rebus
ipsis pugnare tradiderunt. In eiusmodi errores ubivis
incidunt, qui ex Methaphysica Physica explicare aggrediuntur
(24)

Alongside this metaphysical neutrality, the Dialoghi of 1752 stress another aspect of Newtonianism: its practical capacity, the increase of man's dominion over nature which it makes possible. The contrast between Newtonianism and Cartesianism, already articulated on the level of method, the value of truth etc., now occurs on the level of utility.

And where fantastic physics, erroneous in its conclusion-
says Algarotti-as in its relationship, is totally useless
in practical observations, sensible mathematical philosophy,
which due to the certainty of its principles is capable
guessing, is admirably fruitful in everyday life. Whatever
came out of the whole Cartesian school except rumours and
the clamour of vain words? What utility or convenience did
civilized society ever derive from the vortex theory, from
pressure of globular or tenous matter? Whereas modest

Newton, thanks to the new properties he saw in light, perfected our sense with a new telescope; thanks to the attraction he discovered in matter, he truly subjected the planets and comets to our calculations; he made us in a certain sense citizen of the heavens; he made safer and easier for men the ways of an element it seemed nature had excluded him from and for which his compatriots spread commerce, arms and dominion all over the world (p.162)

Perhaps these were not the qualifications accredited to Newton by the scientific community, nor perhaps was this the way in which he offered a new image of the universe. But it was perhaps one of the ways Newton could reach the non-academic audience and come to an agreement with the popularization of the new mentality of Enlightenment. The "powdered" Algarotti, with a bit of naïveté and a bit hurriedly, transferred the Baconian set of his philosophy to his reading of Newtonianism and made the author of the Principia the last great "modern" dominator of nature and benefactor of humanity. Certainly a Newton who was no longer "libertine" but neither, it seems to me, completely outside Enlightenment.

I thus feel we must somehow correct the already-quoted restrictive evaluation furnished by Ettore Bonora on the Dialoghi of 1752, "a work still behind the spirits of Enlightenment". And perhaps we should recall how Fontenelle opened the Histoire de l'Académie des Sciences precisely with a call to utility (although limited) and how d'Alembert's Discours opens the Encyclopédie precisely in Bacon's name. Algarotti, a modest scientist, a reductive render and, if you like, a bit short-sighted regarding Newtonian synthesis, was not a brilliant propagator like Fontenelle; nevertheless, he still succeeds in inserting attraction physics in the mentality of Enlightenment.

Maria Teresa Marcialis

NOTE

- (1) For the biography of Algarotti cf. D.MICHELESSI, Memorie intorno alla vita e agli scritti del conte Algarotti in F.ALGAROTTI, Opere complete, vol.I, Venezia 1791; E.BONORA, under "Algarotti" in Dizionario biografico degli italiani, vol.II, Roma 1960; E.BONORA, Nota introduttiva to F.ALGAROTTI, Dialoghi sopra l'ottica newtoniana, Einaudi, Torino 1977, pp. VII-XI (reprint of vol.49, tome II of the series "La letteratura italiana. Storia e testi", Riccardo Ricciardi Editore, Milano-Napoli 1969); M.DE ZAN, La messa all'Indice del "Newtonianesimo per le dame" di Francesco Algarotti in Scienza e Letteratura nella cultura italiana del Settecento edited by R.CREMANTE and W.TEGA, Il Mulino, Bologna 1984. On Algarotti, also cf. P.CASINI, Les Débuts du Newtonianisme en Italie 1700-1740 in "Dix-huitième Siècle" 10, 1970, pp. 97-100; P.CASINI, Newton in Italia 1700-1740 in Newton e la coscienza europea, Il Mulino, Bologna 1983, pp. 202-207; R.HALL, La matematica, Newton e la letteratura in Scienza e Letteratura cit., pp. 36-46. On Algarotti's optical experiments and on Algarotti confuter of Rizzetti, in addition to Algarotti, Il Newtonianesimo per le dame, Napoli MDCCXXXVII (editor non indicated) pp. 60 foll., 164 foll., 173 foll. and passim, and Dialoghi sopra l' Ottica newtoniana ed. Bonora cit., pp. 120 foll. and passim, cf. I.B.COHEN, I prismi di Newton e i prismi di Algarotti in "Atti della fondazione G.Ronchi", 1957, 12, pp. 213-223
- (2) In the dedication to M. Bernard de Fontenelle, Algarotti greeted the author of the Entretiens in this way: "You were the first, in your Mondi, to call savage philosophy back from solitary Laboratories and scholars' Libraries and take it into clubs and ladies' dressing-rooms. You were the first to interpret to that most lovable part of the Universe those hieroglyphics which were only for the Initiated and you found a way to decorate and straw with flowers what seemed filled with difficulties and thorns" (Cf. Il Newtonianesimo cit., pp. III-IV)
- (3) Cfr. Newtonianesimo cit., p. 8: "according to Mr. Newton's opinion or rather according to what it is"; p. 155: "Now light itself and truth speak with Mr. Newton's voice". Cfr. Dialoghi cit., Dedication to Frederick II, p. 7; p. 12
- (4) On Newtonianism in Italy, besides P.CASINI (1978) and (1983) cit. and R.Hall cit., cf. C.PICHETTI, Per la storia del Newtonianesimo in Italia, "Rivista critica di Storia della Filosofia", XVI, 1961, pp. 429-434; N.BADALONI, Antonio Conti. Un abate libero pensatore tra Newton e Voltaire, Feltrinelli Milano 1960; V.FERRONE, Celestino Galiani e la diffusione del Newtonianesimo. Appunti e documenti per una storia della cultura scientifica italiana del primo Settecento in "Giornale critico della filosofia italiana", 1982, pp. 1-33; V.FERRONE, Scienza Natura Religione. Mondo newtoniano e cultura italiana nel primo Settecento, Jovene, Napoli 1982
- (5) Cf. Il Newtonianesimo cit., pp. 48; 92 foll.; for axiological relativism cf. pp. 65 foll.

- (6) On Algarotti's masonic faith as the cause for Newtonianesimo being listed in the Index cf. M. DE ZAN, La messa all'Indice cit.
- (7) The 1746 edition was entitled Il Newtonianesimo ovvero Dialoghi sopra la luce i colori e l'attrazione; the 1750 edition Dialoghi sopra la luce, i colori e l'attrazione; the 1752 edition, as already stated, Dialoghi sopra l'Ottica newtoniana.
- (8) Cf. E. BONORA, Introduzione to F. ALGAROTTI, Dialoghi sopra l'Ottica newtoniana cit., p. 175.
- (9) Cf. the dedication to Frederick II: "(....) expliquer Newton á un sexe qui aime mieux sentir que connoître" in Dialoghi cit., p. 4
- (10) Cf. M. MALPIGHI, Risposta apologetica (1689) edited and with an introduction by S. BAGLIONI, Roma 1944, p. 99 quoted by W. TEGA, Mens agit at molem. L'Accademia delle Scienze di Bologna (1711-1804) in Scienza e Letteratura cit., p. 70. On the Accademia delle Scienze in Bologna, besides Tega's work and the entire volume Scienza e Letteratura cit., cf. among other works of M. CAVAZZA, Accademie Scientifiche a Bologna: dal "Coro anatomico" agli Inquieti (1654-1814) in "Quaderni Storici", 48, 1981, pp. 884-921; ID. Riforma dell'Università e Accademie nella politica culturale dell'Arcidiacono Masuli in AA.VV., Università, Accademie e Società scientifiche in Italia e in Germania dal Cinquecento al Settecento edited by L. BOHEM and E. RAIMONDI, Bologna 1981; S. BENASSI, L'Accademia Clementina. La funzione pubblica e l'ideologia, Nuova Alfa Editoriale, Bologna 1988 (in part. pp. 20-27)
- (11) Cf. R. HALL, La matematica, Newtoncit., p. 45. But cf. P. CASINI, Les Débuts cit., in which it is said that the Optiks was also "the so-called methodical antechamber of Newtonian synthesis in its totality"
- (12) For a direct quotation from the Optiks cf. Il Newtonianesimo cit., p. 154
- (13) Cf. Il Newtonianesimo cit., p. 115
- (14) Cf. Dialoghi sopra l'ottica newtoniana cit., pp. 105; p. 161
- (15) Cf. R. HALL, La matematica, Newtoncit., pp. 44-45; but cf. P. CASINI, Les Débutscit., p. 91
- (16) Cf. Il Newtonianesimo cit., pp. 15-19 and passim. Cf. Dialoghi cit., p. 6, pp. 15-178; 97-98; 145 and passim. Also cf. Saggio sopra il Cartesio (1754) in F. ALGAROTTI, Saggi edited by G. DA POZZO, Laterza, Bari 1963, pp. 408 foll.; 427 foll. On this subject cf. E. Garin, Storia della filosofia italiana, vol. III, Einaudi, Torino 1966, pp. 965
- (17) Cf. Il Newtonianesimo cit., p. 111; pp. 150-151

- (18) Cf. Il Newtonianesimo cit., p.15. Berkeley is remarked as one who " perhaps more than anyone else considered the metaphysics of vision"
- (19) Cf. VOLTAIRE, Letter to Thierot dated 18 may 1738, Voltaire's correspondence edited by Thedor BESTERMANN, Institut et Musée Voltaire, Genève 1954, vol.VII (letter 1442)p.180
Voltaire's handwriting has been reproduced.
- (20) Cf. Il Newtonianesimo cit., p.129 where Algarotti, proposing to the marquise the substitution of Cartesian by Newtonian physics, leaves the context which sustained Cartesian physics intact, a context linked to the relativity of values, to liberation from the ancients etc. giving the two types of physics a purely technical sense:
" I am not the type to put things to you differently than they really are. Vision will remain intact: the sacrifice you generally make of your appearance will be authentic and formally expressed; the doubts you have about viewing the World (made by men) differently will continue being reasonable and your inclination more towards the Moderns than the Ancients will always be compatible and based on a thousand valid reasons. Reform will concern only the little globes of light and the way in which are aroused by colour sensations; now you may, when you wish, henceforth regard the vortex system as the vaguest and the most beautiful Philosophical Poem existing, which is precisely what I proposed to you from the beginning".
- (21) Cf. for example the last part of Dialogo VI, dedicated to praise of Maupertuis (pp.146 foll.) and to the description of his expedition to the Pole. Also cf. the evaluation of Voltaire "(....) and he who could have been the Lucretius of the Philosophy, preferred to be its Gassend" (p.140).
- (22) Cf. Dialoghi cit., p.93. For Newton's finalism cf. Saggio sopra il Cartesio cit., pp.425-26
- (23) In the I edition (p.9), Algarotti quotes Pemberton, s'Gravesande, Dunch as "zealous propagators of the Newtonian system"; he also quotes Musschenbroek in Dialogo VI stressing his virtues as an experimenter and the free character of his research: " Mr. Musschenbroek, who maintains his characteristic as a free man and a true Republican in his philosophy, says that freely speaking, as benefits a Dutchman, he is forced to confess that for many years and engaged in every type of experience, he observed in all bodies he encountered motion and effects that cannot be explained or understood by the external pressure of some fluid environment, but that Nature loudly proclaims that bodies are instilled with a law according to which they are attracted to one another, independently of impulsion (p.275).
- (24) Cf. P. VAN MUSSCHENBROEK, Elementa Physicae, Gessari, Napoli MDCCLI, p.115