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# UNIVERSITAS

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*UNIVERSITAS is the newsletter of the International Centre for the History of Universities and Science (CIS) at the University of Bologna. It is an occasional publication, with at least one issue a year. Its aim is to circulate news of work in progress in the fields of the history of universities and the history of science and technology. UNIVERSITAS, like CIS, is designed to promote the exchange of information between Italian historians and the international community of scholars. It will be sent free of charge to those interested.*

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*Contents, December 2000:*



## Newton and the baroque

**by Maurizio Mamiani**

### *The material substance*

As he confessed to Antonio Conti[1] in a late private conversation, the young Newton was at one time a Cartesian. However, on presenting his *New Theory about Light and Colours* to the Royal Society in 1672 (a theory that Hooke and Huygens will correctly interpret as anti-Cartesian), Newton was already beginning to develop a play of differences that would lead him to recognise the substantialist and mechanical conceptions of material reality as no longer antithetical. Only certain steps in this transition can be traced: in the juvenile notebooks, for example, Newton wrote that gravitation cannot be a mechanical force because it does not act in proportion to surface, but to mass. Hence the mechanical model – at least as Descartes had constructed it – does not function with gravitation.
In the *New Theory* Newton states that colours are original and innate properties of the various rays of light. And he adds:

> These things being so, it can be no longer disputed, whether there be colours in the dark [they do not exist], nor whether they be the qualities of the objects we see [they are not these either], no nor PERHAPS, whether Light be a Body [this it is]. For, since Colours are the *qualities* of Light, having its Rays for their intire and immediate subject, how can we think those Rays *qualities* also [as the Peripatetics argue], unless one quality may be the subject of and sustain another; which in effect is to call it *substance*. We should not know Bodies for substances, were it not for their sensible qualities, and the Principal of those [the colour] being now found due to something else, we have as good reason to believe that to be a substance also.[2]

Thus Newton believes that colours – or better the rays that support them – are substances, in the Aristotelian sense of subject (*subiectum*, *substantia*), and precisely because of this they are original and innate, and hence immutable (no experiment can modify them). Newton was well versed in Aristotelian physics, at least in its terminology, though he never finished studying the compendium of Aristotelian physics (the *Physiologia*

*Sir Isaac Newton, from an engraving based on a portrait by Godfrey Kneller (1702), National Portrait Gallery, London.*

## The Age that doesn't age

**Paola Bertucci on Roy Porter, *Enlightenment. Britain and the Creation of the Modern World*, London, The Penguin Press, 2000.**

The beautiful cover of Porter's latest book, with its golden capitals and Joseph Wright's *The Orrery* at the top, cannot fail to catch the eye of even the casual bookshop browser. If the visitor has a scholarly interest in the Enlightenment, the fresh smell of ink makes a quick glance at the pages irresistible. For the potential purchaser, Porter's style (and the modest price) easily brushes aside any lingering resistance, and the *peripatetica* of Johannes Magirus) prescribed by the academic curriculum. Hooke attacked Newton for the passage just quoted, a passage so clear that not even the obscurities of philosophical language could save him. He fell back on the "perhaps",[3] prudently inserted. In the published version, a good three notes are inserted at this point, the first of which interests us. Here Newton says that the question can be reduced to a simple nominal distinction. To be understood by the advocates of both philosophies, peripatetic and mechanical, he used respectively the terms "Quality, Subject, Substance, and sensibile Qualities" and "Body, Modes, and Actions", leaving undefined the type of action (by pressure, or by striking, or whatever else), with which light produces the phantasms of colours in our minds.[4] This explanation, certainly involving a fair amount of hypocrisy, risks being all the more dangerous in the eyes of a true advocate of the mechanical. He knows that every time Newton says "body" he also means "substance", i.e. a distinct and irreducible subject that produces sensations in us.

## *The variety of the world*

The dispute with mechanical theoreticians - that Newton cannot avoid - shows that his conception of substance or body is at any rate different from the traditional one. Replying to Hooke, Newton says that mechanical philosophy cannot explain the variety of colours. If white light is uniform and colours are born from an action that modifies them, why ever should this action be preserved through air, a fluid in which every movement tends to become uniform and assimilate itself?[5] In fact, among all the traditional definitions of substance Newton considers only individuality important, because it is the origin of variety. To Huygens, who suggests that two colours would be enough to compose all the others and therefore we should be content with these, he replies:

> No man wonders at the indefinite variety of waves of the sea or of sands on the Shore, but were they all of but two sizes it would be a very puzzeling phaenomenon.[6]

We are here dealing with a fundamental theme of Newton's reflections on the reality of matter. Even if we do not know why the waves of the sea are so varied – i.e. dissolving the metaphor, even if we do not know the substances – we cannot deny their individuality and variety. This theme returns, always in a metaphorical form, in other passages right up until the last years of Newton's life. In 1675 he writes:

> Onely whatever Light be, I would suppose, it consists of Succesive rayes differing from one another in contingent circumstances, as bignes, forme or vigour, like as the Sands on the Shore, the waves of the Sea, the faces of men, & all other naturall things of the same kind differ, it being almost impossible for any sort of things to be found without some contingent variety.[7]

This passage confirms for us that his reading of scholastic physics had been interrupted too early. Here indeed his concept of contingency no longer borders on the traditional concept of individual substance, but on that of accident (that is not immutable, unlike colours).

The reason for this apparent contradiction has to be looked for elsewhere: in the unfinished and unpublished treatise *De gravitatione*. This manuscript holograph, preserved in a bound notebook, has posed serious problem to all interpreters and continues to do so, beginning with its date. The suggestions put forward by Hall, who was the first to edit him, are not decisive. Hall dates the brief manuscript between 1664 and 1668, relegating it to the position of juvenile speculations. But the *Quaestiones* (of which only the title is in Latin) end at the end of 1665 and the *De gravitatione* is too different from it. From 1666 to 1668 Newton is greatly involved with working out a theory of colours, a task he will complete in 1672. For its considerations on method, the start of *De gravitatione* recalls the *Lectiones Opticae* of 1671. Both are in Latin. In 1672 Newton was probably working on the first draft of the *Treatise on the Apocalypse* and had looser contacts with the Royal Society. In 1675 he presented his first hypothesis on ether, with many frequently reiterated reservations concerning the mechanical hypotheses, whose inability to explain individual varieties in the world he underlined.

book on its new owner's shelves gives the satisfaction of an artefact, not just a piece of intellectual work.

The subtitle, "Britain and the creation of the modern world", discloses the author's agenda: to complement and reassess critical studies on the Enlightenment by pointing to the role of Britain in the production (and diffusion) of "enlightened" concepts such as "toleration", "personal freedom", "knowledge", "progress", "education", and "reason". Whereas a number of "classical" works have made of the Enlightenment a French phenomenon, or at any rate definitely not an English one,[1] Porter convincingly argues for the English origins of the "Enlightenment project" to the extent that it was from British sources that French authors took their inspiration. It was to Newton and his proud English followers, for example, that Voltaire referred with admiration in his *Lettres philosophiques ou Lettres anglaises* (1733), and it was Chamber's *Cyclopaedia* (1728, 2nd edn. 1738) that the authors of the *Encyclopédie* (the famed epitome of the Enlightenment) took as the model for their work.

Porter's perspective makes an interesting addition to recent evaluations of the legacy of the Enlightenment.[2] Whether exalted or condemned, the Enlightenment has been made responsible for the creation of the modern world, a view Porter supports, though he invites the reader to see in his book a "work of analysis, rather than one of advocacy or apology".[3] Consequently we find an exploration of the themes that are commonly associated with the "Enlightenment project", with chapters on "print culture" "the culture of science", "the science of politics", "secularizing", "modernizing", "rationalizing religion", "from good sense to sensibility" and "the pursuit of wealth" - all aiming to bring to light its English roots. Porter finds a precious ally in Margaret Jacob, who has argued that "the Enlightenment at large, in both its moderate and radical forms, began in England".[4]

Jacob has also (more recently) pointed out that the possibility of personal freedom under the law, characteristic of the British

## *Immaterial matter*

*De gravitatione* marks Newton's definitive abandonment of the metaphysical implications of mechanical or Cartesian philosophy. But it also marks a going beyond the substantial form in an Aristotelian sense. The problem Newton has to face is a radical one: why do bodies exist, and not nothing? This is certainly the same question Leibniz will also ask himself: why is there something rather than nothing?

The answer is obvious: because God created the world. The world, therefore, does not exist of itself, independently of the act of creation. In other words, it is senseless (and anti-economic) to think that matter, once created, is an autonomous *res*. Matter is formed out of empty space, and by the action of the divine will. Matter therefore is immaterial, or, if we prefer, thought. As opposed to Cartesian dualism, there exists in actual fact only one substance: God.

> 1. That for the existence of these beings [those that compose the world like colours, the gravitational mass etc.] it is not necessary that we suppose some unintelligible substance to exist in which as subject there may be an inherent substantial form; extension and an act of the divine will are enough. Extension takes the place of the substantial subject in which the form of the body is conserved by the divine will; and that product of the divine will is the form or formal reason of the body denoting every dimension of space in which the body is to be produced. 2. These beings will not be less real than bodies, nor (I say) are they less able to be called substances…Nor will they be less substance, since they will likewise subsist through God alone, and will acquire accidents.[8]

Newton is aware he is in this way getting close to peripatetic philosophy. He writes:

> 3. Between extension and its impressed form there is almost the same analogy that the Aristotelians postulate between the *materia prima* and substantial forms…4. They differ, however, in that extension (since it is *what* and *how constituted* and *how much*) has more reality than *materia prima*, and also in that it can be understood, in the same way as the form that I assigned to bodies.[9]

The language Newton uses here is plainly scholastic (perhaps he did not study his Magirus so superficially!) but the outcome is very different. First of all, the emphasis on space, considered as a principle of reality and intelligibility: it is absolute space he is speaking of, the foundation of mechanical properties, but not their essence, as Descartes would have argued. These are the forms Newton is concerned with: the colours as irreducible properties of light, inertia, and impenetrability. Newton's mechanical thinking is thus curiously transformed by the analogy with peripatetic doctrine. Colours as innate and original properties – like bodies endowed with inertia, and impenetrable – are to space what substantial form is to first matter. Where lies the advantage here? The "forms" of which Newton speaks are intelligible, unlike substantial forms. And space is still more so, compared to first matter. In the *De gravitatione* Newton wishes to construct a mechanical science on firmer foundations than those proposed by Descartes. The inertia of bodies, that Newton calls *vis insita*, shares the same character as primary colours, it is original and immutable, it is a "form" that occupies space with its irreducible quality.

The "substance" of Newton is thus constituted of space and forms (impenetrability, inertia etc.) that, together, constitute the body, or matter. There is a metaphor in *De gravitatione* that well illustrates this idea, connected, as has already been mentioned, to the action of God, who to create the world has no need to communicate to matter a substantial reality of its own:

> In the same way we see no material shapes in clear water, yet there are many in it which merely introducing some colour into its parts will cause to appear in many ways.[10]

Narcissus admiring his image in the pool – a great theme in the painting of high culture – does not know that the water returns to him precisely the same reality of which he is composed. Caravaggio's famous picture illustrates a passage from Ovid's *Metamorphoses*, and only through their stupidity do the historians of science not remember that a 1593 edition of the *Metamorphoses* was the first book Newton bought as a student at

monarchy, exerted a profound fascination on foreign *philosophes*.[5] The constitutional state created a pattern that was reproduced on a smaller scale in numerous philosophical, political and literary societies, whose number multiplied during the Enlightenment. There was also the tradition of religious toleration that came to characterise the British Enlightenment: thanks to the tolerant climate in religious matters, non-conformist and radical thinkers, such as Joseph Priestley, William Godwin and Thomas Paine, could express their dissent from the Established Church and articulate their views on secularization.

The importance of religious tolerance in giving voice to secularizing forces is repeatedly emphasised in *Enlightenment*, especially when Porter calls the reader's attention to Joseph Priestley as a protagonist in the strenuous advocacy of the separation of religious from secular power. Surprisingly neglected by scholars of the Enlightenment, Priestley actively championed the cause of rational dissent in British political life. His non-conformist views, though prompting the outraged response of High-Church divines, resulted in the creation or consolidation of new sources of education – the Dissenting academies – that stood as valid and accessible alternatives to the elitist (and politically colonized) Oxbridge universities.

Education, or more properly, the means to obtain education, was a leading issue of the "enlightened age". In line with his view of the Enlightenment as an intellectual process that gave birth to an *intelligentsia* of opinion-makers operating in the public arena created by the press, Porter does not limit his analysis of "enlightened education" to institutional settings: equally significant for "enlightened" gentlemen and gentlewomen was self-education, both as a complement to or as a substitute for academic education. Editions of classical texts, translations from Greek and Latin, together with new publications especially made in response to the demand for self-education, made publishing houses thrive. Culture became marketable: ladies' and gentlemen's magazines were issued monthly and readers could satisfy their thirst for political

*Caravaggio,* Narcissus, *Galleria Nazionale di Arte Antica, Rome.*

Cambridge (on the flap, dated 15 October 1659, can be read *Isaci Newtoni liber* and the price). In Newton's library there is also an English 1656 translation of the *Metamorphoses* and a good three editions of the works of Ovid, dated respectively 1656, 1664, and 1715.[11] The habit of reading Ovid thus continued well beyond the years of his youth.

## *Newton's baroque imagination*

It is unreasonable to believe that we are dealing here with a mere coincidence. During the Seventeenth century many aspects of the baroque imagination are surprisingly in line with the style of the men of science. In these same years, Newton was interested in the interpretation of the Apocalypse. His exegesis took the dream as a fundamental metaphor. The dreams of Joseph and the kings of Babylon, interpreted by Daniel, testified that God preferred the use of oneiric language to reveal the future. Thus, the Apocalypse was like a dream: decoding the Book of Revelation was the same as interpreting a dream. The language of dreams was composed of figurative expressions. As a result, Newton's observations on the language of the prophecies were profoundly influenced by baroque visual culture, according to the Renaissance tradition of emblems and devices. Newton draws especially on an Arab medieval writer, Achmet, who wrote of the events and meanings of dreams, justifying his choice thus:

For ye Prophets wthout doubt spoke in a dialect then commonly known

news as well as their curiosity about all sorts of novelties. Contributors to these publications took their readers around the "new" worlds that the colonial empire continued to reveal, contributing to mould an enlightened cosmopolitanism with accounts of voyages around the globe, and related descriptions of foreign civilizations. Travel literature was a best-selling genre, and Porter shows how published texts (books, magazines and newspapers) created an occasion in which national borders could be crossed simply by reading.

The "enlightened" press gave birth to a "print culture" that was not just successful business, but also the laboratory in which a typical product of the Enlightenment was forged: public opinion. The variety of publications that could be found on coffee-house tables made politics, religion and culture, popular conversation-topics. The *Monthly Review*, *Critical Review*, and *Literary Magazine*, to mention just three of the numerous eighteenth-century British magazines entirely devoted to the art of reviewing, played a significant role in decreeing the success or failure of a newly published book and, above all, they played an essential role in stimulating discussions on various topics in coffee-houses and other meeting-places. The political standing of the editor (the dissenter Ralph Griffith for the *Monthly*, the Tory Tobias Smollet for the *Critical*) was crucial in the selection of the reviewers and, as a result, it influenced the articles' contents; hence, contrasting reviews often hid more fundamental differences on religious and/or political matters, which were often discussed in social gatherings by the "clubbable" readers.

Fund-raising also exploited the power of the printing press, and a sense of collective morality was promoted by opinion-makers, who championed the view that order might be more easily achieved by the use of reason rather than by the sword. Paternalism and philanthropy were keywords among enlightened patrons, who funded charities and hospitals both in London and the provinces. The creation of "public culture" was essential to the creation of a sense of national identity, characterized by an understanding of the history

> to ye more understanding sort of men, & many of their types & figures wch are unusual & difficult to us appear by these records of Achmet to have been very familiar to those Eastern nations; at least among their interpreters.[12]

In Newton's private library[13] there was a copy of Nicolas Caussin's *De symbolica Aegyptiorum sapientia* (Cologne 1631). Caussin was a well-known author, of baroque eloquence. There was also a copy of Giovanni Valeriano's *Hieroglyphica*, a famous book of sacred emblems, and a work by Emanuele Tesauro, one of the theoreticians of the new rhetorical, lapidarian and symbolic art.

It is worth noticing that Tesauro compares the ability of mankind to produce metaphors and symbols to the creative action of God:

> Just as God produces what is from what is not, so the genius of a non-being makes a being, turns the lion into a man and the eagle into a city, grafts a female on to a fish and creates a siren as symbol of the flatterer.[14]

In the same way, the emblem of the apocalyptic dragon contained various meanings in one. Of course, every emblem has multiple meanings, but according to Newton, not in an arbitrary way:

> A Dragon signifies ye person of a *hostile* King, & serpents according to their bignes the persons of other greater or lesser enemies Achm: c 288. According to wch doctrin ye Apocalyptic Dragon is a very proper emblem as well of ye Roman Kingdom wch was so great an enemy to ye Church, as of ye Devil that arch-enemy to mankind. But there seems to be in this emblem a further mystery: namely to insinuate a comparison of ye oppression of ye Church under ye Roman Empire to ye Egyptian Bondage, as if that were a type of this.[15]

The single emblem - the dragon – joins together many events simultaneously. We have thus reached the heart of prophecy's possibilities and the deepest layer of meaning of figurative language. In the figure – the emblem, the device, the oneiric image – time can be contracted so much that every event is condensed into its expressive capacity. The typology of the dragon, on the foundation of the analogy, allows the prophet to foresee later events: Egyptian bondage is the type of the Roman Empire as Antichrist is the type of the devil.

Newton uses these constant products of the imagination (emblems meant as types) as if they were universal definitions, establishing upon them the possibility of an unambiguous interpretation of the Apocalypse. The figures are not, in any case, external accessories. Newton insists on the unifying function of the emblems, because of their rational nature, in opposition to the excessive liberty of "a luxuriant ungovernable fansy" that "borders on enthusiasm".[16]

Newton carefully analysed the mechanism of the baroque metaphor. Since the emblem links various kinds of events together without ambiguity, the syntactic construction of the content of the Apocalypse is possible according to the laws of prophetic language. To discover what these laws are, Newton constructs a hermeneutic method in which every emblem is exactly defined:

> First I shall lay down certain «Rules» general Rules of Interpretation, ye consideration of wch may prepare the judgment of ye Reader & inable him to know when an interpretation is genuine & of two interpretations which is the best. Secondly, To prepare the Reader also for understanding the Prophetique language I shall lay down a short description thereof, showing how it is borrowed from comparing a kingdom either to ye Universe or to a Beast: So that by the resemblance of their parts the signification of ye figurative words & expressions in these Prophesies may be apprehended at one view & limited from ye grownd thereof. By wch means the Language of ye Prophets will «appear» become certain & ye liberty of wresting it to private imaginations be cut of. The heads to wch I reduce these words I call Definitions.[17]

## *The* regulae philosophandi *of the* Principia

The rules to interpret the lexis and language of the prophetic writings will, in the *Principia*, become the *regulae philosophandi*. Analogy now becomes

of humankind in terms of a progressive development leading to the British state as the peak in civilization and openness.

Public opinion and the demand for culture that it involved were closely linked to the expansion of a commercial society grounded on economic liberalism and *laissez-faire*. Any branch of knowledge was potentially marketable, and the relatively new "experimental" philosophy lent itself particularly well to the tastes of both polite society and industrial culture. The "industrial revolution" increased the sensibility for progress and usefulness that made of natural philosophy an activity for entrepreneurs, not just for gentlemen. Public lecturers such as Adam Walker, James Ferguson and Benjamin Martin realised that experimental philosophy could become a successful business. Its potential depended on the mixture of usefulness and entertainment: technical questions could be answered by exploiting the theatricality of experimental demonstrations. Porter's chapter on the "culture of science" emphasises the commercial dimension of experimental philosophy, even though it leaves the historian of science somewhat perplexed. He presents the creation of a market for experimental and natural philosophy according to the interpretative trends of recent studies of the rise of public science, and his attention to secularizing forces and the political climate invests his picture of "enlightened science". Even where the reader is ignorant of the cultural history of science, the chapter will give him/her at least a flavour of the current trends in the historiography of science. On the other hand, and here comes the perplexing surprise, Porter seems to take "science" and "scientific method" as unproblematic concepts. He describes the "marriage between science and Enlightenment", under the aegis of the "career, achievements and image of Isaac Newton",[6] giving the reader the impression that there was (Newtonian) science, and there was the Enlightenment, and that they met in the course of the eighteenth century, with the result that the former enacted principles (secularization, or the struggle against superstition) that the latter

the key to our reading of the book of nature. Nature is to be read like prophecy, because God is both author of the infinite world and of eternal prophecy.
Newton's successors (and Newton himself) will call the use of analogy in scientific enterprise 'induction'. Nothing could be more misleading than this term, borrowed from Aristotelian logic, for an understanding of the use of analogy in Newton's work. For example, Newton compares the colour spectrum to the tonal scale, and finds numerical correspondences there.[18]
In the so-called classical *scholiai* (a series of commentaries on the *Principia*) Newton is convinced that the ancients had glimpsed the law of gravitation in their affirmation of the harmony of the heavenly spheres. The harmony of the heavens is the type of gravitation just as the Babylonian bondage is the type of the Roman Empire. The analogy of nature is not logical induction through simple enumeration, but the search for types. Here we have an alternative way of explaining why an apple falls! The falling apple becomes the "type" of the moon.
If we consider the second rule of the *Principia* and its commentary, we can gain a greater understanding of the doctrinal weight hidden behind statements that may appear to us quite banal:

> As far as possible we must assign the same causes to natural effects of the same kind. Like respiration in man and beasts; the fall of stones in Europe and in America; the light in the fireplace and in the sun; the reflection of light on the earth and on the planets.[19]

The anecdote of the apple – probably true, whatever many suspicious historians might say – is rooted in the typology of the Apocalypse and Baroque emblems, which was a continuation of the Renaissance emblem system.
The inductive method is logically fallacious, as Hume and his successors (Russell for one), went out of their way to demonstrate. The induction used by Newton does not belong, however, to logic, but to figurative and symbolic language. Historical research has at least this advantage: it makes us understand how false problems and misunderstandings are born. If these are often fertile in their unforeseen outcomes, they do sometimes lead into sterile disputes, such as this gigantic, senseless one about induction.

## De gravitatione *and the general scholium of the* Principia

We can now come back to the concept of substance in *De gravitatione*. At the end of the proposal for an immaterial substance, we find another surprising assertion: the similarity between man and God.[20] It is the same concept we found in Tesauro,[21] the theoretician of baroque eloquence. For Newton this similarity is by no means a simple theological given. It is the foundation of his conception of matter, since God is to matter what man is to his body. The human will is the type of the divine will. It may seem that Newton takes his analogical language too far. And yet his conception of matter and the fundamental elements of his cosmology are to be sought in this basic analogy between man and God. Every difficulty concerning the nature of bodies can be reduced to our faculty of moving our bodies, that is to say, in virtue of the analogy, to the will of God.[22]
The similarity between man and God is preserved in the general *scholium* of the *Principia*.[23] Man is a type of God. In conformity to this similarity, Newton tried for many years to perfect a theory of an immaterial ether. The ethereal spirit would have provided an explanation of gravitation, animal motion and the forces that act in the microcosm, such as electrical and magnetic attraction. It could have been the intermediary between the thinking spirit and the non-thinking body[24] between God and the world. Newton's baroque science is the theatre of divine manifestations, since the world is like a dream of God. As he writes in *De gravitatione*: "For certainly whatever cannot exist independently of God cannot be truly understood independently of the Idea of God".[25] We can find the result of this thinking on God, the world and man, continuing over time through the most varied of experiences, in the general *scholium* of the 1713 *Principia*. The *scholium* is not very long, but there Newton condenses his metaphysical and methodological convictions, those he had been working out all his life, entrusting them mostly to writings that had been left at the bottom of his trunk. At the start Newton explains the difficulties the

produced or, conversely, that the latter created a market where the former prospered.
While the creation of public opinion, of national identity, and of secular thinking, are regarded by the author as among the main features of the Enlightenment, it is surprising that when it comes to science the emerging of this particular form of knowledge should be left on the margins of the Enlightement's results. It is probably in the economy of a brilliant book, whose aim is to contribute to a reassessment of the role of Britain in the creation of the modern world, that the complex transformation of natural philosophy into science should be left to the footnotes. But it could be counter-argued that the emergence of science during the Enlightenment was so constitutive of "modernity", as to be necessarily included in analyses of the creation of the modern world.
Overall, Porter's work is an exciting study of the Enlightenment and its British roots. It is comprehensive, informative and enjoyable, appealing to the general reader as well as the scholar. And this is certainly rare. Given the wide spectrum of features that Porter has taken into account, some specialists may well raise their eyebrows, but as an original contribution to the vast range of interpretations of the legacy of the Enlightenment its value is beyond doubt.

## Notes

1. E. Cassirer, *The philosophy of the Enlightenement*, Princeton, 1951; P. Gay, *The Enlightenement, an Interpretation*, London, 1967; H. S. Commager, *The empire of Reason: how Europe imagined and America realized the Enlightenment*, London, 1978; R. Anchor, *The Enlightenment tradition*, New York 1967; J. G. A. Pocock, "Post-Puritan England and the Problem of the Enlightenment", in P: Zagorin (ed.), *Culture and politics from Puritanism to the Enlightenment*, Berkeley, 1980, 91-111; D. Outram, *The Enlightenment*, Cambridge, 1995; R. Darnton, "George Washington's false teeth", *New York Review*, 27 March 1997.
2. W. Clark, J. Golinski, S. Schaffer (eds.), *The sciences in Enlightened Europe*, Chicago, 1999.
3. Porter, *Enlightenment*, p. xxi
4. M. Jacob, *The radical Enlightement: pantheists, freemasons and republicans*, London, 1981, p. 79; quoted in Porter, *Enlightenment*, p. 30.
5. M. Jacob, *Living the Enlightenment:*

Cartesian hypothesis of vortexes meets with. Then he says that the regular motions of the universe do not originate in mechanical causes, and therefore they could not be born without the intention and the domination of a intelligent and powerful being. Newton's God is at the same time the Lord God and king, that had been made manifest in the prophecies and mystical writings, and the God of order, that, with his actual omnipresence in space, guarantees the regularity and the harmony of the universe. However, Newton asserts vigorously that God is not the spirit of the world: God is everywhere, but not everything is of God. He puts forward a vision of the universe, that goes back to the uncompleted tract *De gravitatione*. In the Scholium Newton argues for a radical phenomenalism (apparently in contradiction with his original substantialist orientation, that had got him into such serious trouble with Hooke), denying that one can know the substance of something (in the *De gravitatione* he even denied that matter had a substance).

> We know very little about what the substance of something is. We see only the figures and the colours of bodies, we hear only the sounds, we just touch the external surfaces, we just smell the odours, and taste flavours: we do not know the intimate substances with no sense, nor any act of reflection; and still less do we have an idea of the substance of God.[26]

But we can grasp the order and regularity of things, i.e. the structure of the world, the sign of divine perfection. Newton's initial substantialist orientation, so evident in the 1672 memorandum on colours, and also in the conception of absolute space and time, was apparently turned into a phenomenism based on sensory experience. The entire variety of things depends in fact on ideas and on the will of just one being, who necessarily exists, God. Natural philosophy speaks of God, when it grasps the structure of reality (the true substance of things is therefore God). After this declaration in favour of phenomenalism, it is not surprising that Newton says he does not know what gravity is, but only what it isn't: it is not a mechanical force. Its action, extending everywhere over immense distances, is indispensable for the order and regular functioning of the universe. But the reason for the properties of universal gravitation cannot be sought in phenomena (at least, he says that he did not succeed there). So Newton does not pretend to put forward false hypotheses.
The rejection of the hypotheses is therefore the extreme consequence of the conception of Newtonian matter. Is this a form of scepticism? I leave the answer to the reader. Experimental philosophy respects the variety of the world and can grasp its mathematical structure, that returns to us only one of the components of matter. To go beyond, is not just mistaken, but blasphemous. It means, as Newton said in the treatise on the Apocalypse, to struggle against God, to substitute his action and his will with ours. But it also means that the world appears to mankind in an irreducible and vain variety, as if it was purely a product of the imagination.

## Notes

1. A. Conti, *Prose e poesie*, t. II, Venice, 1756, p. 26.
2 I. Newton, *The correspondence*, H.W. Turnbull ed., Cambridge University Press, vol. I, p. 100.
3. *Ibid*., p. 173.
4. *Ibid*., pp. 105-6.
5. *Ibid*., pp. 175-6.
6. *Ibid*., p. 264
7. *Ibid*., p. 370.
8. *Unpublished scientific papers of Isaac Newton*, A. Rupert Hall and M. Boas Hall eds., Cambridge University Press, 19782, p. 140. The original text runs: "1. Quod ad horum entium existentiam non opus est ut effingamus aliquam substantiam non intelligibilem dari cui tanquam subjecto forma substantialis, inhaereat: sufficiunt extensio et actus divinae voluntatis. Extensio vicem substantialis subjecti gerit in qua forma corporis per divinam voluntatem conservatur; et effectus iste divinae voluntatis est forma sive ratio formalis corporis denominans omnem spatij dimensionem in qua producitur esse corpus. 2. Haec entia non minus forent realia quam corpora, nec minus dici possent substantiae…Nec minus forent substantiae, siquidem per solum Deum pariter subsisterent et substarent accidentibus", *ibid*., pp. 106-7.
9. *Ibid*., pp. 140-1. The original text is: "3. Inter extensionem et ei inditam formam talis fere est Analogia qualem Aristotelici inter materiam primam et formas substantiales ponunt…4. Differunt autem quod extensio (cum sit et quid, et quale, et quantum) habet plus realitatis

*freemasonry and politics in eighteenth-century Europe*, New York, 1991.
6. Porter, *Enlightenment*, p. 132.

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# Scientific objects in history

Giuliano Pancaldi on Lorraine Daston (ed.), *Biographies of scientific objects*, Chicago and London, The University of Chicago Press, 2000.

Initiatives aimed at blurring the opposition between realism and constructivism, that has rippled across the public image of science studies in recent years, gathered momentum around 1995 and continue to bear important fruits. Two books appeared in 1995 containing pleas for a "pragmatic realism". Their aim (conceived in different ways by their authors) was (among other things) to avoid both naive realism about natural entities, and the extreme relativist conclusions reached by some constructivists. In one of these books Jed Z. Buchwald and Silvan S. Schweber wrote:

> By "pragmatic realism" we (loosely) mean a commitment to the efficacy in practice of entities and effects that are engaged by, and that are not (merely) produced by, experiments. This naturally requires that we not yield to the ever-present temptations of absolute skepticism, while nevertheless insisting on the constructed character of scientific knowledge. By "constructed" we mean that scientific knowledge is actively produced rather than passively read off from a natural codex, as it were.[1]

In another book, Andrew Pickering devoted several pages to illustrating his own version of pragmatic realism. This concerns "machinic performances and representational chains and how they are aligned with one another in time". It is a "noncorrespondence realism", because it "specifies nontrivial links between knowledge and the world

quam materia prima, atque etiam quod intelligi potest, quemadmodum et forma quam corporibus assegnavi", *ibid*., p. 107.
10. *Ibid*., p. 133. The original text runs: "Ad eundem modum intra aquam claram etsi nullas videmus materiales figuras, tamen insunt plurimae quas aliquis tantum color varijs ejus partibus inditus multimodo faceret apparire", *ibid*., p. 100.
11. Cfr. J. Harrison, *The library of I. Newton*, Cambridge University Press, 1978, p. 208.
12. I. Newton, *Trattato sull'Apocalisse*, M. Mamiani ed., Turin, Bollati Boringhieri, 1994, p. 50.
13. Harrison, *The library of Isaac Newton*, p. 116.
14. E. Tesauro, *Il cannocchiale aristotelico*, Turin, 1670, p. 82.
15. I. Newton, *Trattato sull'Apocalisse*, p. 78.
16. *Ibid*., p. 22.
17. *Ibid*., p. 18
18. Cfr. P. Gouk, *The harmonic roots of Newtonian science*, in *Let Newton be!*, J. Fauvel, R. Flood, M. Shortland, R. Wilson eds., Oxford University Press, 1988, pp. 101-26.
19. I. Newton, *Philosophiae naturalis principia mathematica*, A.Koyré and I. B. Cohen eds., Harvard University Press, 1972, p. 550.
20. *Unpublished scientific papers of Isaac Newton*, p. 141. The original text goes: "et in super ut Analogiam inter nostras ac Divinas facultates majorem esse ostenderem quam animadvertere Philosophi. Nos ad imaginem Dei creatos esse testatur sacra pagina. Et imago ejus in nobis magis elucescet si modo creandi potestatem aeque ac cetera ejus attributa in facultatibus nobis concessis adumbravit", *ibid*., p.108.
21. Cfr. n. 14.
22. *Unpublished scientific papers of Isaac Newton*, p. 141. The Latin text is: "Huius itaque naturae corporeae descriptionem a facultate movendi corpora nostra deduxi ut omnes in conceptu difficultates eo tandem redirent", *ibid*., p.107.
23. "Omnis homo, quatenus res sentiens, est unus et idem homo [...] Deus est unus et idem deus", I. Newton, *Philosophiae naturalis principia mathematica*, p.762.
24. "This spirit therefore may be the medium of sense & animal motion & by consequence of uniting the thinking soul & unthinking body.", MS Add. 3970, f. 241r.
25. *Unpublished scientific papers of Isaac Newton*, p. 110. The original runs: "Nam certe quicquid non potest esse indipendenter a Deo, non potest vere intelligi indipendenter ab Idea Dei", *ibid*., p. 110.
26. I. Newton, *Philosophiae naturalis principia mathematica*, p. 763.

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## Bologna science classics online

With the support of the Italian National Research Council (CNR, Cultural Heritage Project), CIS is developing a new series of science classics that will be available full text online. The series will include texts, illustrating the practice of science at the University of Bologna over the centuries, that have reached a world-wide reputation. The first title in the series is: Luigi Galvani, *De viribus electricitatis in motu musculari* (Bologna, 1791), edited by Marco Bresadola, now available online at the address http://cis.alma.unibo.it/online.htm.

## Bologna Studies in History of Science

The series Bologna Studies in History of Science now includes the following volumes: 1. F. L. Holmes, *Eighteenth-century chemistry as an investigative enterprise*, 1989, 144 pp.; 2. J. H. Heilbron, *Weighing imponderables and other quantitative science around 1800*, 1993, 337 pp.; 3. F. H. Holmes, *Between biology and medicine: the formation of intermediary metabolism*, 1992, 114 pp.; 4. P. J. Bowler, *Biology and social thought: 1850-1914*, 1993, 95 pp.; 5. *I laboratori dell'università. Un incontro Bologna-Oxford*, edited by Anna Guagnini, 1996, 127 pp.; 6. Robert Fox and Anna Guagnini, *Laboratories, workshops, and sites. Concepts and practices of research in industrial Europe, 1800-1914*, 1999, 214 pp.; 7. *Luigi Galvani International Workshop. Proceedings*, edited by Marco Bresadola and Giuliano Pancaldi, 1999, 215 pp. Some of the volumes are available from CIS.

that are quite independent of relations of correspondence"; but it proclaims itself a "*non-sceptical* position".[2]
The valuable collection of papers edited by Lorraine Daston under the title *Biographies of scientific objects,* originating in a conference held in 1995 in Berlin, pushes the search for a way out of the opposition between realism and constructivism further.
According to the agenda Daston sets out in her Introduction, "scientific objects can be simultaneously real *and* historical", and the authors of the papers included in the book "converge in assigning scientific objects a different kind of reality than that set forth in the conventional two-valued metaphysics that obliges us to choose unequivocally between 'x exists'/ 'x does not exist' or 'x is discovered' / 'x is invented'." [3]
The objects discussed in the volume belong to physics, economics, psychology, biology, anthropology, demography, medicine, sociology, and to sciences that no longer exist, like "preternatural philosophy" (Lorraine Daston, "Preternatural philosophy"). They include atoms (Jed Z. Buchwald, "How the ether spawned the microworld"), as well as dreams and the self (Doris Kaufmann, "Dreams and self-consciousness. Mapping the mind in the late eighteenth and early nineteenth centuries"; Jan Goldstein, "Mutations of the self in old regime and post-revolutionary France"); motion (Rivka Feldhay, "Mathematical entities in scientific discourse. Paulus Guldin and his *Dissertatio de motu Terrae*"), as well as economic value, society, and culture ( Gérard Jorland, "The coming into being and passing away of value theories in economics (1776-1976)"; Peter Wagner, "'An entirely new object of consciousness, of volition, of thought'. The coming into being and (almost) passing away of 'society' as a scientific object"; Marshall Sahlins, "'Sentimental pessimism' and ethnographic experience. Or, why culture is not a disappearing 'object'"); mortality rates (Theodore M. Porter, "Life insurance, medical testing, and the management of mortality"), as well as tuberculosis and cytoplasmic particles (Bruno Latour, "On the partial existence of existing *and*

# Seventh International Summer School in History of Science, Berkeley 2000

*Participants in the Seventh International Summer School in History of Science, Berkeley, June 12-17, 2000.*

The seventh International Summer School in History of Science – a joint initiative of historians of science from Berkeley, Bologna, Paris, and Uppsala – was held in Berkeley from June 12-17, 2000. The theme of the School was: "New Knowledge and Hi-Tech in the Twentieth Century". David A. Hounshell (Carnegie Mellon), Martin Kenney (University of California at Davis), Daniel Kevles (California Institute of Technology), and Donald MacKenzie (Edinburgh) were the lecturers. Other speakers included Glenn Bugos, Tim Lenoir, Henry Lowood, David Mowery, Dominique Pestre, Paul Rabinow, and Nick Rasmussen. The School was attended by about sixty people – doctoral students, post-doctoral students, and young academics – from eight countries. Professor Roger Hahn, the convener of this seventh School, Professor Cathryn Carson, the Director of the Berkeley Office for History of Science and Technology, and the staff of the Office provided excellent working conditions and a friendly atmosphere, to the satisfaction of all participants. The next School will be held in Paris in 2002, on a theme to be announced.

non-existing objects"; Hans-Jörg Rheinberger, "Cytoplasmic particles. The trajectory of a scientific object").

To the present reviewer, the wealth of narrative detail and nicely focused interpretive issues dealt with in each one of the stories told in the book are, and will probably remain, its most valuable contribution. This is especially the case of the papers in which the detail and the circumstantial interpretive issues are conjured up to emphasize the plurality of cultures, actors and interests involved in scientific practice; a plurality that poses recurrent challenges to the kind of epistemological generalizations nurtured by controversies like the one that has developed around social constructivism.

The plurality of cognitive and laboratory cultures, that combined in the making of the microworld as newly conceived by physicists ca. 1890, is a major point in the conclusions that Jed Z. Buchwald draws from his study of late nineteenth century German and Dutch science. Plurality, and the diversity of the actors engaged in scientific practice, as well as the interests involved in the search for standardization and objectivity, figure prominently also in the lesson Theodore M. Porter draws from his study of "the management of mortality". Together with Lorraine Daston's carefully balanced Introduction, Buchwald's and Porter's stories are precious antidotes to the kind of hasty generalizations that have been encouraged within the "science wars" debate.

Readers of *Biographies of scientific objects* will enjoy many other episodes discussed in the book, as well as the vividness of some of Bruno Latour's reflexive comments on the "science wars" themselves, such as the following:

> Constructivism and realism are two *synonyms*, every builder knows that, but the differences between what does and what does not have a history has managed to transform, through the years, a constructivist position about natural entities into a critical, skeptical, and even deconstructionist position. Strange paradox of our intellectual history.

Or again:

# *"Il mondo in ordine"* The scientific image of the world (16th-18th centuries) seen through the museums, collections, and laboratories of Bologna

*Exhibition at Palazzo Poggi, Via Zamboni 33, Bologna (September 2000-January 2001)*

After two centuries, thanks to extensive restoration work which is part of a larger project, Palazzo Poggi is now able to return to its former role as a strikingly remarkable centre of learning. While still remaining the seat of the Chancellor of the oldest western university, Palazzo Poggi has again become home to the instruments and equipment of the old Istituto delle Scienze. In addition, the building's 16th century frescoes and decorations have been re-opened to visitors.

Since the Napoleonic period, when the collections were first scattered among various sites, a large number of the instruments belonging to the Istituto delle Scienze became part of the most important city museums. The (partial) recovery of the University's remarkable collections has enabled us to recreate, with a good degree of philological accuracy, the research and teaching environment that brought fame to the scientific activity carried out in Bologna in the 16th-18th centuries. Indeed, the Istituto delle Scienze, founded by Luigi Ferdinando Marsili and given far-sighted support by Pope Benedict XIV, appears to have been a remarkable institution, unique in Europe at that time. According to illustrious visitors, neither the Royal Society nor the Académie des Sciences could count on such complete and well-equipped collections and laboratories. It was these collections and laboratories that, for the first time, gave practical significance to the modern ideal of scientific knowledge based on observation, experiment, and calculation. This ideal was the guiding principle linking the several rooms ("*Camere*") of the Palazzo: the Natural History Gallery, which housed Marsili's collections and which was enlarged between 1742 and 1743 by the addition of the collections of Ulisse Aldrovandi and Ferdinando Cospi; the Chemistry laboratory, which was a noticeable exception in Italy in those days; the Physics laboratory, which became famous for its research activity on optics and, later, electricity; the Anatomy and Obstetrics rooms, equipped for the training of anatomists, surgeons and obstetricians; the Geography and Navigation Gallery; the Specola, fitted with state-of-the-art instruments for positional astronomy; the Military Architecture rooms, dedicated to the study of applied mathematics and rational mechanics. To these of course must be added the Accademia delle Scienze (Academy of Sciences), the Accademia di Belle Arti (Academy of Fine Arts), and its School of nude studies, the Antiquities Collection, and the Library and the Printing office. These institutions formed the basis of Bologna's unique scientific tradition and the remarkable achievements of Palazzo Poggi.

As J. W. von Archenoltzt put it in 1787: "An enormous collection of everything which is necessary for the study of the sciences and the practice of art… A sort of encyclopaedia for the senses… All these things, which are not scattered here, there and everywhere, as is the norm, create here, for their being collected together, a huge body, whose single parts, in themselves, would be nothing noteworthy..."

The exhibition "*Il mondo in ordine*" traces the development of the Institute's scientific activity, which continued to achieve outstanding results throughout the modern era. It includes Ulisse Aldrovandi's Museum, a valuable example of late Renaissance natural encyclopaedism; the Ferdinando Cospi Collections, notable testimony to the combination of *naturalia* and *artificialia* that 17th collectors pursued; and Marsili's science laboratories. Among the scientists who worked at the Institute there were Eustachio Manfredi, Francesco Maria Zanotti, Jacopo Bartolomeo Beccari, Laura Bassi, Leopoldo Caldani and Luigi Galvani.

The recent enlargement and partial reallocation of the neighbouring University Library made possible the restoration of friezes and ceilings, which are among the finest examples of late Renaissance figurative art.

> What progress could we make if we could disentangle the political question of maintaining social order from that of describing the history of the sciences? What step forward could be taken if we could depoliticize the sciences from the heavy burden that epistemology and Higher Superstitions have imposed on them for purely political reasons...?[4]

## Notes

1. Jed Z. Buchwald and Sylvan S. Schweber, "Conclusion", in Jed Z. Buchwald (ed.), *Scientific practice. Theories and stories of doing physics*, Chicago and London, The University of Chicago Press, 1995, pp. 345-351, 345.
2. Andrew Pickering, *The mangle of practice. Time, agency, and science*, Chicago and London, The University of Chicago Press, 1995, pp.180-186, esp. 183.
3. Lorraine Daston, "Introduction. The coming into being of scientific objects", in Lorraine Daston (ed.), *Biographies of scientific objects*, Chicago and London, The University of Chicago Press, 2000, pp. 1-14, 3.
4. Ibidem, p. 269. A revised and expanded version of Latour's paper has been published in Bruno Latour, *Pandora's hope: essays in the reality of science studies*, Cambridge Mass., Harvard University Press, 1999, chapter 5. The allusion in the quotation, above, is to Paul R. Gross, Norman Levitt, *Higher superstition: the academic left and its quarrels with science*, Baltimore, Johns Hopkins University Press, 1994.

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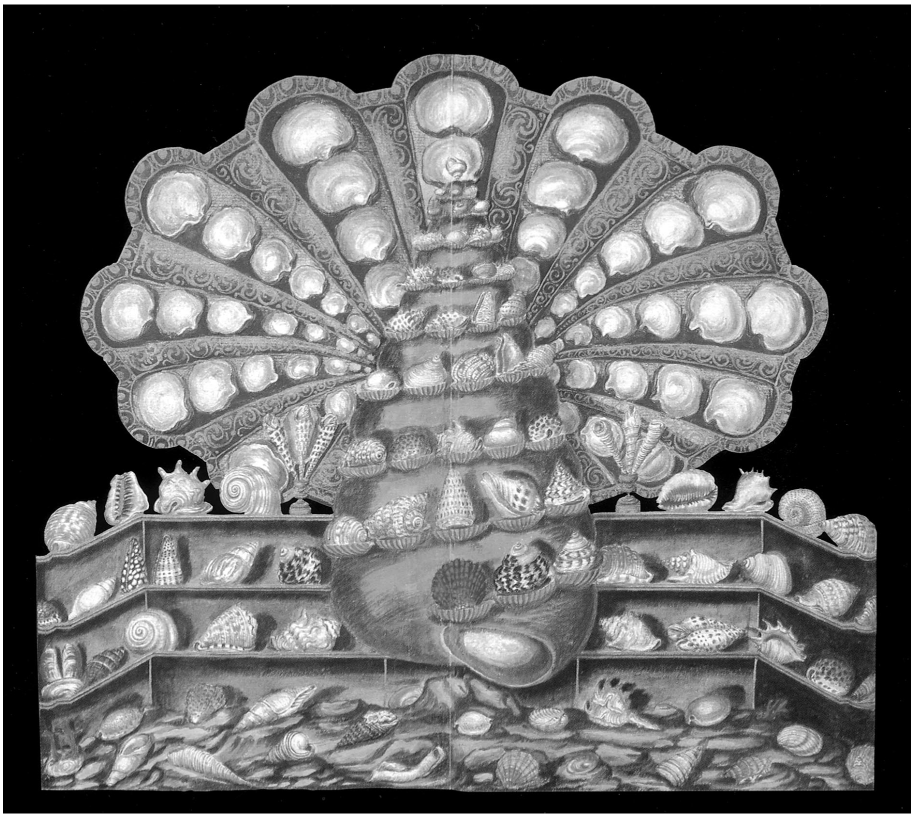
# The Museum of the Ninth Centenary of the University of Bologna

## *Palazzo Poggi, Via Zamboni 33, Bologna*

Palazzo Poggi, the main seat of the University of Bologna, was for a long time the chosen seat of the city's culture, and it now once again hosts the scientific collections of what was, in the early eighteenth century, one of the first scientific academies in Europe: the Istituto delle Scienze.

The synthetic representation of the cultural heritage of the University of Bologna is now entrusted to the



They include Nicolò dell'Abate's *Storie di Camilla*, *Paesaggi*, *Concerto* and *Fatiche di Ercole*; the cycle of *Susanna*; the episodes of the life of *Moses*, the work of Prospero Fontana and Ercole Procaccini, the episodes of the lives of *Saul* and *David*, based on a project of Prospero Fontana, and emblems, allegories and grotesques. These works are the masterpieces of the splendid iconography of Palazzo Poggi, a museum within the museum. The opening of the museum-rooms of Palazzo Poggi, and the Bologna 2000 European City of Culture program, have thus provided the opportunity to hold an exhibition of scientific objects pointing to the important role that Bologna played in European culture in the 18th century.

*(Walter Tega)*

Scientific Committee of the exhibition: *Walter Tega* (coordination), *Roberto Scannavini* (design), *Ottavio Bernabei, Biancastella Antonino, Valeria Babini, Jadranka Bentini, Marco Beretta, Fabrizio Bolletta, Fabrizio Bonoli, Gian Paolo Brizzi, Ovidio Capitani, Antonio Carile, Marta Cavazza, Giovanni Cristofolini, Giorgio Dragoni, Franco Farinelli, Vera Fortunati, Giorgio Giacomelli, Giuseppe Olmi, Alessandro Ruggeri, Sergio Raffi, Bruno Sabelli, Giuseppe Sassatelli, Raffaella Simili, Stefano Tommasini, Sandra Tugnoli Pattaro.*

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Museum of the Ninth Centenary *(Museo del IX Centenario)*, that exploits the new information technologies to represent the University's history, ancient and modern, as well as to recall the celebrations held in 1988 to commemorate - on the initiative of the then Rector Fabio Roversi Monaco - the nine centuries since the establishment of the University. The project aimed to create a new kind of museum, capable of handling "collections" consisting only of information, presented through visual and sound performances illustrating objects, episodes, leading figures and, in general, everything that interactive digital technologies can communicate to the widest possible public.

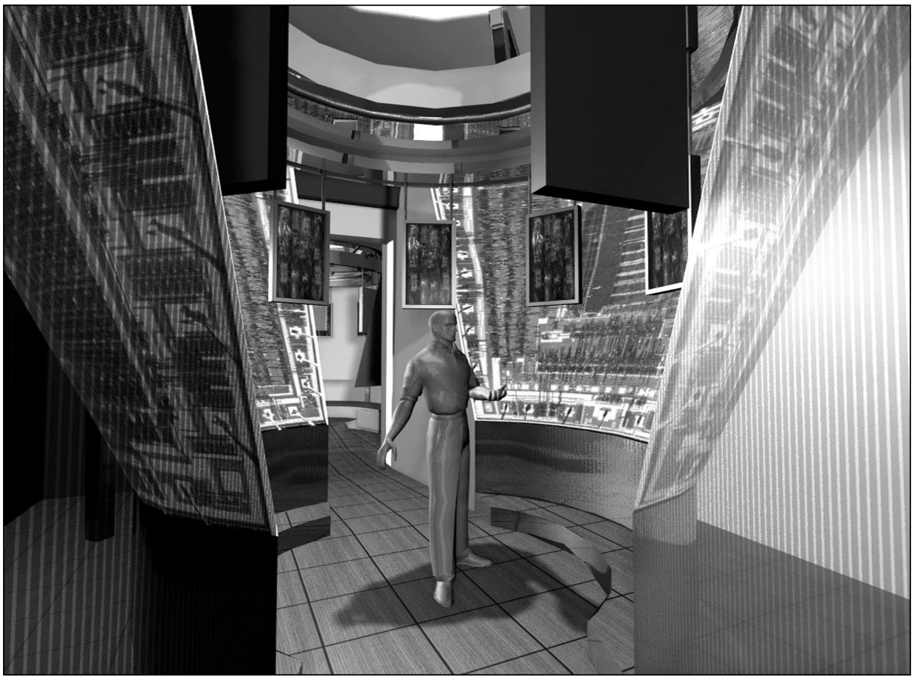
*I. The rooms of time (The astrolabe)*

The section of the Museum called "the rooms of time" was created using the techniques of multiple interactive projection, on 2 panoramic screens of 7 by 3 meters. In each room there are 4 columns, each one devoted to a century of University history. These are the menhirs of a kind of Stonehenge, positioned to observe – by means of a sort of electronic astrolabe, operated by the visitor - portions of a great sky against whose constellations appear events of the history of the University, together with major historical events. These fragmentary, stroboscopic visions can be pieced together through the astrolabe by the visitor, who can thus see the University as it was at the time of Irnerio, Copernicus, Galvani, Carducci, or Righi... or can adopt the vantage points of Federico of Svevia, Charles V, etc., through the 308 digital videos available in this section.

*II. The Centerama. The rooms of space (The aleph)*

These rooms are devoted to the events of the last century, and to the ninth centenary of the University of Bologna. Two exhibits are set up in this room, made up of two mobile rings supporting monitors projecting their images on cloth cones. The machines project complex scenes, within which various observation points open up to the visitor. The exhibits called "aleph" consist of nine plasma videos mounted on the inner ring, eight external lcd projectors, a structure of outer mirrors (to obtain the desired dimensions of

*Computer generated images ("Maya" software, Alias Wavefront) of the Museum of the Ninth Centenary, University of Bologna.*



retroprojection on the cone of cloth that contains the mobile ring), and twenty computers governing the projections, the interaction, and the motion of the machines. A radio connection guarantees the communication of data between the computers positioned on the ring, and those governing the projection and interaction.

The aleph – conceived as a sort of machine for observation - represents events on the inner space of the room, close to the visitor, but within the broader framework provided by a twentieth century universe. The honorary degrees conferred upon the protagonists of contemporary, scientific and civic life, the great conferences, the participation of Nobel prize-winning scientists, artists, and politicians, joining in the celebrations of the ninth centenary of the University, as well as the solemn ceremony for the signature of the Magna Charta Universitatum, are the salient episodes narrated by the Centerama.

### *III. The Ark. The rooms of the ritual.*

The third section of the Museum, the one that links together the space and time of the exhibition, is devoted to "the Ark". As a sort of liturgical space, this section houses the only "real" object in the Museum: the original of the Magna Charta Universitatum. It also conveys to the visitor information illustrating the present state of the University of Bologna .The room of the ark contains a design shaped like an ellipse. In the two fires of the ellipse (traced on the floor) there are, on one side, a semisphere, called "the planet", in which the events of the signature of the Charta Magna are represented with multiple projections. On the other fire of the ellipse there is a transparent strongbox, containing the original of the Charta. Above the "planet", in the perimeter of the ellipse, six columns recalling the pipes of an organ provide additional, technical and scenographical support for the histories and data being conveyed to the visitor. On the opposite side, close to the Magna Charta, there are a number of tri-dimensional pictures on the walls.

*(Andrea Zanotti with Carlo Fiorini)*

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