THE SCIENTIFIC REVOLUTION IN NATIONAL CONTEXT

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I

SCIENTIFIC REVOLUTION, SOCIAL BRICOLAGE, AND ETIQUETTE

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EARLY modern Italian science has received and continues to receive so much attention that no summary or synopsis could do justice to the available historiography.[1] Therefore, this essay does not try to offer a synthetic picture of the development of the various scientific disciplines in Italy between 1500 and 1700. Instead, taking the title of this book seriously, I will try to locate some of the conditions that framed the development and subsequent crisis of Italian science during the Scientific Revolution. Some comparison of the cultural and political contexts of Italy and other European countries will help identify possible connections between different national contexts and different aspects or phases of the Scientific Revolution.[2] The essay concludes by suggesting a range of homologies between the development of scientific discourse, authorship and institutionalization during the Scientific Revolution and what Norbert Elias has called the 'civilizing process' – the development of court society, political absolutism and the modern state.[3]

DECLINE OR MARGINALIZATION?

For some time, the crisis of Italian science after Galileo's death was conveniently explained away by the religious obscurantism that was claimed to have set in after his trial in 1633. The attribution of such a central causal role to the trial reflects a tendency in the older historiography to turn Galileo's career (with its brilliant start and abrupt ending) into the epitome of Italian modern national science. While older histories of English and French science may reflect a Whiggish orientation stemming at least to some extent from the authors' appreciation of the successes of their modern national science, in the case of Italy Galileo (rather than the state of modern Italian science) became a mythical point of historiographical reference.[4] Rather than writing the

history of science as leading to a successful present, the older Italian historiography tended to present late seventeenth-century science as sucked back in time by the black hole of Galileo's trial.

Recent work has shown that such a simple explanation will not do: late seventeenth-century Italian science cannot be reified into a 'scuola galileiana' that sank with its hero.[5] True, Italian science did become increasingly marginalized from the European scene after *1670* or so, yet this crisis was not as drastic as previously suggested nor did it affect all scientific disciplines. For instance, the Church's condemnation of Galileo did not affect disciplines whose subject matter did not impinge on cosmology and theology, and it has been recently argued that even its influence on astronomy was less severe than previously assumed.[6] Moreover, observational astronomy boomed during the later seventeenth century (mostly due to the new astronomical telescopes produced by the Italian instrument-makers Fontana, Divini, and Campani) and Giovanni Domenico Cassini was arguably the leading figure of this subdiscipline.[7] Similar scenarios of non-declining scientific productivity can be observed in disciplines as diverse as medicine and electricity.[8]

Then, if we consider the geographical distribution of scientific activity, we notice that it spread more evenly over the Italian peninsula (especially in the centre and south) during the seventeenth century.[9] Similarly, institutional support of scientific activities does not seem to have declined in Italy after the death of Galileo. Not only did Prince Leopold de' Medici begin to gather, in 1657, the Accademia del Cimento (perhaps the first scientific academy dedicated to experimental practices), but it seems that the Italian branch of the Society of Jesus maintained its support for science during the rest of the century.[10] In short, not only did science not leave Italy after 1633, but if we look at the statistics of Italian publications in the mathematical sciences during the seventeenth century, we notice that productivity peaked in the period 1661–70.[11]

This said, I am not trying to depict a polemically rosy picture of post-Galilean Italian science. It is undeniable that, by 1680, the centres of European science were no longer Padua or Florence, but Paris and London. Nevertheless, evidence of the continuing development of Italian science illustrates the problems of notions such as 'decline' or 'progress' – notions that imply the use of Whiggish (or nostalgic) terms of reference. Instead, by thinking of scientific change as an open-ended and non-directed process, we may avoid the problems posed by notions such as 'progress' or 'decline' while acknowledging that the differentiated development of science may reflect the different environments (the regional and national contexts) in which it happened to be situated.[12] I propose to analyse some of these processes and to identify some of the features of the seventeenth-century Italian context that were responsible for that pattern of scientific change that (when viewed from our present point of view) appears as the 'decline' or 'marginalization' of Italian science at the end of the Scientific Revolution.

THE NEW CONTEXT

Economic and political historians agree on the drastic decline of Italy's importance after 1600. By the beginning of the seventeenth century, the duchy of Milan had long lost its independence and had become a territory controlled by Spain. Tuscany was still rich but it was also turning into a provincial and agricultural state with little international relevance. The Florence where Galileo died in 1642 was much poorer (and much less populated) than the city where he grew up. The income of the Medici grand dukes in 1625 seems to have been about half of what it was in 1590.[13]

Urbino – once the seat of the prestigious court described in Castiglione's *Book of the Courtier* – experienced a sharp economic decline at the end of the sixteenth century and disappeared from the political map in 1631 when it was finally incorporated in the Papal State. After having been one of the most sophisticated Italian courts in the fifteenth and sixteenth centuries, Mantua (the court to which Galileo tried to migrate in 1604) lost its importance and eventually its independence around 1629.[14] Venice remained quite powerful, yet it too was experiencing a sharp decline in wealth and political relevance.[15]

Venice's decline was exemplified by its reduced control over the central and eastern Mediterranean – a sea that used to be the busy freeway of east-west trade.[16] Writing to Galileo in 1611, Giovanfrancesco Sagredo told him that, in returning from Syria where he had been residing as the Venetian ambassador, he had to land in Marseilles because the Venetian navy could no longer keep the Adriatic Sea free of pirates.[17] In any case, the commercial importance of the Mediterranean was quickly declining as a result of the opening of oceanic trade routes. Galileo's system of determining longitude at sea, which relied on the satellites of Jupiter as astronomical clocks, was not put to use by his Medici patrons, whose fleet was largely symbolic. Instead, he tried, with his patrons' help, to sell his method first to Spain and then to the Netherlands – two countries that, because of their interest in oceanic trading, had advertised large prizes for the solution of the problem of determining longitude at sea.[18]

Only the Papal State was able to delay its participation in the overall decline of the political and economic relevance of the Italian peninsula; it actually grew (temporarily) stronger with its annexations of various smaller states. However, by about 1650, even the popes had to face a sharp decline in their international power. As shown by Urban VIII's troubles during the Thirty Years' War (troubles that contributed significantly to the context of Galileo's trial), the Pope could no longer even act as the diplomatic arbiter between the great European rulers.

The marginalization of Italian science in this period and the contemporary emergence of France and England as the new scientific centres was linked to these broad politico-economical changes. This is supported by a comparable crisis in other aspects of Italian culture. Francis Haskell has described the decline of Italian and Roman art and artistic patronage after the death of Urban VIII in 1644, and its subsequent migration toward northern Europe. Such a decline was epitomized, in the 1660s, by the (temporary) move to Paris of the symbol of the Roman baroque: Gian Lorenzo Bernini.[19] As many Italian and Roman artists were quick to realize, Louis XIV, rather than the Pope, was the new great patron.[20] Tellingly, Louis XIV was able to summon to Paris in the same years the best Italian sculptor and architect (Bernini) and the best astronomer (Cassini).[21]

LEGITIMIZING THE NEW SCIENCE

Although these considerations suggest a strong link between Italy's politico-economic decline and the crisis of its science during the later part of the seventeenth century, one should not assume a direct causal relationship between the development of science and the presence of cash-abundant patrons or of thriving manufactures. Without denying that such a relationship holds true in many cases, we should not forget that patrons tended to be particularly concerned with (and to spend to maintain) the visibility of their *magnificentia* precisely when their economic status was declining. In seventeenth-century Italy, we find that the most interesting scientific authors and activities were sponsored by economically declining patrons.

It was not Ferdinand I – the last grand duke of Tuscany with a strong militaristic, colonial, and technological bent – who patronized Galileo, but his son Cosimo II – the ruler under whom Tuscany became a provincial agricultural state.[22] Similarly, Prince Leopold de' Medici sponsored the Accademia del Cimento (as well as a remarkable art-collecting programme) at a time when Florence's power had drastically

(and permanently) declined.[23] Federico Cesi – the founder of the Accademia dei Lincei in 1603 – embarked in a costly enterprise just when his family (like all the other families of the Roman baronage) was being bled to financial ruin by the increasing concentration of political and financial power in the hands of the new papal families.[24]

Therefore, rather than seek a simple relationship between general categories like 'science', 'economy', 'culture' and 'politics', we may try to break down these categories and consider the *processes* through which *different* types of science fitted *specific* audiences and patrons and, second, how these *different* scientific practices needed *specific* institutional settings, forms of social legitimation and financial support. In doing so, I will try to indicate how the development of political absolutism and of the related power-image of the prince framed science's options for patronage and social legitimation.

The earliest scientific institutions we know of (the botanical gardens and the theatres of anatomy that emerged in several Italian cities in the mid-sixteenth century), or the early technical corps (like the *capitani di parte* operating in Florence from Dante's time), were public institutions sponsored primarily because of their usefulness to medicine or to the technico-military needs of the *community*.[25] Other scientific practices, by contrast, were much more appealing to *individual* princely patrons not primarily because of their practical usefulness but because they could effectively contribute to the patrons' status and image.[26]

In 1610, for instance, the Medici did not offer Galileo an unusually well-paid position at court because of the usefulness or Copernican relevance of his astronomical discoveries. They gave him a stipend of a thousand *scudi* a year and the title of Philosopher and Mathematician of the Grand Duke because he was able to present his discoveries as emblems of Medici power and dynastic continuity.[27] In short, Galileo's unusual success reflected his ability to offer the Medici something that was not a *generic* service (that could have been delivered by anybody) but something that was *exclusively* distinctive of the Medici's image and status.

This type of scientific patronage cannot be dismissed as historically insignificant, a mere sign of the frivolousness of baroque princes. On the contrary, a scientific practitioner's ability to play on aristocratic codes of distinction and present discoveries and practices within that discourse was crucial in overcoming the lower social and cognitive status of innovative scientific disciplines like astronomy and anatomy. Being represented as inferior in social and epistemological status to philosophy and medicine (respectively), astronomy and anatomy were seen as unable to challenge the traditional views held by those more respected

disciplines. However, the 'status gap' that hindered the acceptance of scientific innovation could be effectively bridged by obtaining the patronage of high-status patrons like the Medici – a patronage relationship that could lift the social status of the client.[28]

As was first indicated by Robert Westman, the legitimation of Copernican astronomy entailed a re-drawing of the boundary and hierarchy between technical astronomy, natural philosophy, and theology – the 'Queen of the liberal arts'.[29] The Copernicans did not limit themselves to a mathematical *description* of the cosmos (the traditional domain of technical astronomy) but made claims about its *physical structure* and about the *causes* of some celestial phenomena (claims that traditionally pertained to the natural philosopher). By relying on the higher status and epistemological credibility conferred upon them by the received disciplinary hierarchy, the philosophers countered what they perceived as the astronomers' 'disciplinary trespassing' by dismissing the legitimacy of their claims and methodology, arguing that the astronomers had applied their tools to a domain that was not their own. Analogous tensions, perceived invasions and methodological disputes took place in other fields where the domains of natural philosophy and mathematics overlapped, such as in mechanics and hydrostatics.[30]

A strategy often adopted by astronomers and mathematicians to circumvent the status gap between themselves and the philosophers was simply to move to a different institution – to a different social space where the social and cognitive status of their discipline could be freed from the constraints of traditional disciplinary hierarchies. As shown by the careers of some German and Italian Copernicans, the princely court was such an institution.[31] At court, one's social status and credibility depended less on one's discipline and more on one's favour with the prince. This higher socio-disciplinary status could then help the mathematicians-astronomers defend their new hierarchy-disrupting world-views.

A comparable gap in social status and cognitive authority existed between theoretical medicine and surgery. Several of the medical achievements of the Scientific Revolution were connected to the sixteenth-century revival of the investigative study of anatomy (quite conspicuous in Italian universities) and of its teaching through dissection. Before then, anatomy was treated as a subsidiary component of medical training. It was seen as a means to illustrate and demonstrate the physicians' doctrine rather than as a tool for discovery. As shown by several frontispieces of late medieval anatomy texts, the surgeon was usually not seen as an independent researcher but rather as the physician's manual assistant.

The development of investigative anatomy was not unproblematic. To practise 'hands-on' anatomy, one needed to be skilled in surgery – a discipline that, because of its mechanical connotation, had a low social and cognitive status.[32] Like philosophers who claimed for themselves the right to *explain* the causes of the astronomical phenomena *described* by technical astronomers, physicians – by relying on the hierarchy of medical practices – acted as if they alone could *explain* what the surgeons had *observed* through their manual skills. Quite simply, physicians (or philosophers) were the head and surgeons (or astronomers) were the hand. Or, to put it differently, both astronomy and surgery stopped at the 'surface' of natural processes, while philosophers and physicians (endowed with 'theory') could go much 'deeper' and uncover the real causes of the observable phenomena.[33]

The analogy between astronomy and anatomy can also be traced at the level of the tactics adopted by their practitioners in order to legitimize themselves and their disciplines. Like Galileo who managed to transform himself into a philosopher by representing the satellites of Jupiter as a dynastic emblem of the Medici, the leaders of the revival of anatomy tried to improve the status of their discipline by representing their practices as fitting the codes of gentlemanly and aristocratic culture.[34] John Stephen of Calcar's large and artistically etched anatomical illustrations for Vesalius' *De humani corporis fabrica* (which he published in 1543 while he was *explicator chirurgiae* at Padua) reflects, I think, strategies comparable to Galileo's.[35] By depicting skeletons and skinned bodies as elegant Classical sculptures placed against an appropriate backdrop of ruins, Vesalius and his cohorts were trying to bring about a radical change in the social connotation of their profession.[36] Judging from the size (a folio volume of 663 pages), quality and cost of Vesalius' masterpiece, it was not only a scientific text, but also a status-statement and a patronage artefact.[37] Just as the increased social status of the court Copernicans was a resource they could use to legitimize their new theories (and new socio-professional identities), the higher status anatomists could obtain by representing themselves as *virtuosi* (rather than barbers) was crucial in establishing investigative anatomy as a cognitively legitimate branch of medicine.[38]

To summarize, the Scientific Revolution was at least two revolutions in one. Together with the radical conceptual changes that took place in the fields of astronomy, physics, medicine and methodology, a new disciplinary hierarchy that legitimized the new theories and methods was slowly established. The restructuring of disciplinary boundaries, hierarchies and status was made possible both by the practitioners' migrating to institutions that allowed for higher social status and

mobility, and by the establishment of new social spaces (such as scientific academies) through which practitioners could legitimize their activities and emerging socio-professional identities.

OPTIONS AND CONSTRAINTS

The acceptance of new world-views depended also on the social legitimation they derived from the 'matches' between the practices of the scientific practitioners and their patrons' cultural taste and 'distinction' – a process that has been carefully studied by Pierre Bourdieu in the modern period.[39] However, such matches were difficult to come by. Gaining support and legitimation for a new theory or discipline implied an often opportunistic rearrangement of elements of pre-existing social scenarios. Let me sketch a few examples of these 'social bricolages'.

Quite probably, the cities and universities of Bologna and Padua viewed anatomy theatres and botanical gardens primarily as educational facilities. However, these institutions also had other social meanings. Not only were they signs of the university's status as a leading academic centre, but they were also city 'monuments' and 'mirabilia' that quickly found their way into tourist guides.[40] Moreover, anatomy theatres tended to become sites of important civic rituals. For instance, in Pisa, Rome, Ferrara, Bologna and (less frequently) Padua, public anatomy lessons took place during the carnival festivities. As shown by Giovanna Ferrari, the Bolognese public dissections (performed in the anatomy theatre) were also a civic ritual through which the government and the university publicly recognized and confirmed each other's role and jurisdictions.[41]

These scientific institutions had further meanings for the practitioners. Although botanical gardens and anatomy theatres were professionally important institutions that provided financial long-term support for the practitioners in charge of them (a support no longer tied to the accidents of an individual patron's life), their establishment was even more important because of the status they could confer on the disciplines they housed. In short, they were much more than buildings accommodating students and providing instructors with possibly adequate teaching facilities and decent salaries. As publicly supported institutions, anatomy theatres and botanical gardens legitimized and stabilized emerging (or previously less legitimate) branches of medicine.[42]

The establishment, around 1595, of the anatomy theatre at Bologna offers an interesting analogy with the institutional migrations of Copernicans from universities to courts outlined above. As shown by

Ferrari, the anatomy theatre was founded at a time when the city was trying to restrict the privileges of the university. By establishing and funding the theatre, the city was also trying to wrest control over the public anatomy lesson away from the university of scholars. Teachers of anatomy (who had often been marginalized within the university of scholars) profited from this institutional struggle and, like Copernicans who gained higher socio-professional status and credibility by moving to court and becoming clients of a prince, they welcomed the new and more distinguished patron.[43] What these examples have in common is that the migration to a new institution made possible the re-negotiation of the practitioners' socio-professional status through their playing into some sort of *raison d'état* – be it the celebration of the image of the absolutist prince or the support of the state's attempt to extend its centralized control over formerly independent institutions.

Just as princely courts made it possible for sophisticated mathematicians like Galileo to improve their social status by displaying dialectical and courtly skills during court disputations, anatomy theatres provided practitioners with a stage where they could perform their 'anatomical plays' and present themselves as *virtuosi* by displaying their *surgical nonchalance*. In a sense, public dissections were the performative equivalent of the artistic etchings of dissected bodies in Vesalius' *Fabrica*.[44] Reporting on the dissections performed by Niels Steno (who would later be employed at the Medici court) in a Parisian scientific academy, a French *virtuoso* wrote to a friend that 'M. Steno is the rage here' and

> When I called us apprentices next to M. Steno, I had reason, for I have never seen such dexterity. He made us see everything there is to see in the construction of the eye – without putting either the eye, the scissors, or his one other small instrument anywhere but on his one hand, which he kept constantly exposed to the gathered company.[45]

The anatomy theatre was also a 'sacred space' – a space in which a disturbing and usually unacceptable practice like human dissection could have its social connotation inverted. What was a crime outside the theatre became science once it entered it. Once in the theatre, the dissected corpse was no longer a defiled body but rather some sort of 'monument' (almost a 'sacrifice') to the new science of anatomy.[46] That such a 'sacralization' of the 'profane' was a process involving major rearrangements of social taxonomies and values may be deduced from the customary scheduling of public anatomies during the carnival, that is, in a period in which society was already 'upside-down'.

The drastic inside-outside distinction cast by the boundaries of that space mirrored the distinction between the professional insiders and

outsiders. In this sense, the theatre was a tangible image of anatomy as a profession and of its social and cognitive legitimacy.[47] This relationship between space and professional legitimation may explain why – in the Bologna case studied by Ferrari – some of the audience watched the dissection wearing carnival masks. It may be that the mask-wearing spectators did not have medical credentials and therefore – lacking the professional 'virtue' to transform the profane into the sacred – they had to watch the dissection *incognito*.[48] Wearing masks while participating in an activity that, under normal circumstances, would have been inappropriate to one's status was a standard option of etiquette discussed in Castiglione's *The Book of the Courtier*.[49]

Similar links between scientific practices, status dynamics, and institutions can be found in another of the earliest sites of science: the museum of natural history. As shown by Paula Findlen and Giuseppe Olmi, collecting was a deeply status-laden practice.[50] Museums were nodes within networks of exchange and patronage in which collectors, clients and patrons reproduced and negotiated their status as they exchanged natural specimens as gifts.[51] As Findlen puts it: 'We can imagine the museum as a social diagram whose contents concretely expressed the nature of the relations between patrons and clients, donors and recipients.'[52] In a sense, museums were 'banks of status' in and around which gifts–specimens were displayed or exchanged in the same way that money is deposited in and circulated by modern banks. Like Galileo, who gained social status by contributing to the Medici's image through his donation to them of his astronomical discoveries, smaller collectors gained status by contributing to the great collector's image, that is, by donating their specimens and having them exhibited in his museum. However, there were important differences in the practices and options of social legitimation of Galileo, the anatomists and the natural history collectors.

As Galileo was quick to realize, his scientific discoveries could be best rewarded by an *individual* absolute prince rather than by *corporate* patrons like republics or cities.[53] By fitting his *exceptional* discoveries into the codes of courtly patronage, he managed to enter into a *personal* relationship with a great patron. Because of this 'closeness' to an absolute prince, his social and epistemological status could be increased more effectively than through the patronage of an impersonal patron like the republic of Venice – Galileo's former employer. However, if such a personal patronage relationship (based on an *exceptional* discovery) made it possible for the client to go up in the socio-professional scale, it also made it very difficult (if not impossible) to institutionalize that patronage and extend it to non-exceptional scientific practices.[54]

Moreover, although the Bolognese anatomists, the natural history collectors and Galileo all gained status from contributing to the image of their patrons, Galileo's 'gifts' could not be delivered routinely at every carnival (as with the anatomists) nor could they be included in a museum (as with the collectors). His gifts to the Medici could not be produced, shelved and exposed at will. Far from being a problem, their non-ready-madeness confirmed their exceptionality: this, in turn, made them fit the image of an absolute (i.e., eminently *distinct*) prince. In fact, the 'museum' where the Medicean Stars were exhibited was the cosmos itself, and only absolute rulers provided with suitably dynastic mythologies linking them to celestial gods could represent that space as 'their own'.[55] Consequently, Galileo's gifts would have been 'above the head' (and outside the patronage space) of most patrons.[56] Only a very few patrons were socially equipped to squeeze image out of Galileo's discoveries.[57]

In short, although the 'social bricolage' achieved by anatomists and natural history collectors was structured by the same dynamics that framed Galileo's negotiations with the Medici, the resulting bricolages were quite different. The type of science they practised (and the way the world was) demarcated what type of 'gifts' they could produce. In turn, those 'gifts' matched the patronage possibilities of specific patrons and shaped the type of patronage relations (institutional or personal) that would ensue. To use a chemical analogy, different patrons, disciplines (at different stages of articulation) and scientific practices had different patronage 'valences'.

Although it may be impossible to produce some sort of 'Mendeleev Table' mapping the relationship between different types of scientific practices, disciplinary hierarchies, types of patrons and patronage, institutional spaces and social status, these examples have indicated some of the protocols of 'social bricolage' through which emerging scientific practices tried to gain socio-epistemological legitimation. Let me now turn to analyse some of the ways in which these processes were played out in the politico-economical scenarios of late seventeenth-century Italy.

PROVINCIAL ABSOLUTISM AND THE LEGITIMATION OF SCIENCE

The scientific practices whose legitimacy and public usefulness had been long established and recognized through institutionalization were not drastically affected by the new politico-economic conjuncture. For instance, it does not seem that the decline of the Italian economy caused

the closing down of botanical gardens or anatomy theatres. That Italian medicine continued to produce top-rank scientists like Francesco Redi and Marcello Malpighi (and, later, Lazzaro Spallanzani) may confirm the relative stability of the 'ecological' and institutional niche that medicine had established for itself.[58]

More unstable were the scenarios faced by the practitioners of those disciplines that – like astronomy – had not yet been given an institutional setting outside of the university but had seen *individual* practitioners sponsored by *individual* princes. Moreover, no Italian mathematician after Galileo managed to maintain the important title of 'philosopher' (a crucial resource for the cognitive legitimation of the mathematical analysis of physical phenomena) which he had obtained from the Medici in 1610. When, for instance, after 1642, Evangelista Torricelli was chosen as Galileo's successor, Ferdinand II gave him only the title of '*Mathematician* of the Grand Duke'.

That no other Italian astronomer managed to reproduce a bricolage similar to Galileo's is not only a matter of princely taste. In fact, the constitution of the solar system made it impossible for other astronomers to come up with discoveries as *spectacular* as Galileo's.[59] Moreover, his discoveries – being many, stunning, concentrated in a short period of time, and happening when nobody expected them – had made patrons and audiences less impressed by further discoveries. Although the debate on Saturn's rings attracted much attention, prince Leopold de' Medici – the patron to whom Huygens dedicated his *Systema Saturnium* (1659) – did not react to it nearly as enthusiastically as his father had welcomed Galileo's discoveries of 1610.[60] Similarly, the finding of the first satellite of Saturn by Huygens in 1655, and Cassini's finding of more in 1671/2 and 1684, produced little patronage interest.[61]

Moreover, although many observational astronomers continued to scan the sky with increasingly powerful telescopes (these by 1665 could be as long as twelve metres), the causes of planetary motion was the theoretical problem at the centre of many astronomers' and mathematicians' attention. And this was a technical problem that could not have been turned easily into a courtly marvel. For instance, Newton's mechanics as presented in the *Principia* could not easily have been turned into something as eminently dedicable (and tailored to a specific great patron) as the satellites of Jupiter.[62] In short, after Galileo, the conditions for 'bricolage' between astronomy and the image of the princely patrons were no longer there partly because of the way the solar system happened to be and because of the direction taken by astronomical work. Finally, because Italian princes were not the rulers of large, commercially or militarily active states, they probably did not see a good

investment in establishing scientific academies whose members could also act as technico-scientific consultants.

To summarize, Italian princely patrons declined to patronize the newer trends in astronomy because these seemed less than spectacular; they could not reward observational astronomy (as they had done in Galileo's time) because spectacular discoveries were exceedingly hard to come by; and they were not interested in patronizing science in general because the states they were ruling did not need such technico-scientific expertise. Let me now test this analysis against the evidence provided by a different national context: late seventeenth-century France.

FROM COSIMO II TO LOUIS XIV

Louis XIV's decision to create the Académie des Sciences in 1666 was not exclusively motivated by his belief that science would solve the technical problems of his kingdom and foster its manufactures. In any case, the Académie did not distinguish itself for the practical usefulness of its activities and findings during the early decades of its activity.[63]

By establishing the Académie, Louis XIV did not offer an institutional setting to *one specific science* (like an anatomy theatre), nor did he reward one *individual* practitioner for producing an astonishing discovery and representing it as an effective emblem of royal power (like the Medici with Galileo). Because of the representation of himself as *the* absolute and all-powerful sovereign, Louis XIV's image would not have benefited much from receiving the dedication of a scientific discovery from an individual client unless it was *absolutely* marvellous and *absolutely* suited to his own image. Unfortunately, the solar system did not provide astronomers with the resources (lily-shaped sunspots, say) to produce such an absolutely fitting image.[64] Louis XIV's power image could be enhanced only by artefacts (paintings, histories, poems) *representing himself* and his absolute power and not just *dedicated to him*. Louis' own image was the sole adequate representation of his power.[65]

Instead, Louis' grand patronage gesture toward science can be better understood by viewing it as indissolubly tied to the 'academic package' that Colbert proposed him, and by looking at how Colbert's project perfectly fitted the representation of the Roi Soleil's absolute power.[66] In fact, since he was trying to present himself as the most powerful and absolute of all sovereigns, it was best for him to be perceived as controlling *all* sciences and major arts by institutionalizing them under his protection. This was a strategy that suited his power image much better than the patronage of *one* specific (though possibly exceptionally

conspicuous) practitioner of *one specific* science. In short, by establishing the Académie des Sciences together with the other royal academies, Louis presented himself as having conquered one more realm: the *republic of letters*.

Therefore, the shift from the reward of *a specific and well-fitting marvel* and its producer (or the institutionalization of *one specific scientific discipline*) to the establishment of a scientific corporation comprehending *all sciences* was also caused by the changes in the codes of representations of princely power resulting from the formation of large and increasingly centralized states like France. The 'patronage valence' of the great prince had changed between Cosimo II and Louis XIV. Let me expand on this.

The Medici patronized Galileo because of the remarkable dynastic monuments he had made out of his astronomical discoveries, but were not interested in sponsoring any long-term Copernican 'research programme'. Dynastic monuments would enhance the Medici's image; Copernican astronomy would not. Although the politics of representation of princely power that informed Louis XIV's image were quite similar to those that framed that of the Medici rulers, the specificity of the French context led to a very different scenario of scientific patronage. As shown by the monumental astronomical observatory Louis had built at the outskirts of Paris, he viewed the Académie des Sciences as a monument to himself and to his own power (to the point where the monumentality of the building collided with the practical needs of the working scientists).[67] Similarly, Louis wanted to include all the sciences under his patronage so as to demonstrate his 'absolute' control over them. This gesture resulted in an institution because only a conspicuously walled institution could act (and last) as a monument to his power.

The Medici rewarded Galileo because he helped to 'naturalize' their rule by showing that it had been 'written in the sky'. Louis behaved as if he did not need naturalizing representations of his power.[68] The naturalness of his power was an axiom and not something in need of demonstration. Consequently, he did not need a scientist to contribute (*via* nature) to his image. Louis' founding of the Académie des Sciences was not a recognition of a 'gift' received from a scientist – as it had been with the Medici. Louis did everything by himself, unsolicited, like an unmoved mover. He gave an institution to the scientists because, by doing so, he was not returning a gift but simply displaying his own absolute power. He was obliged by his greatness.

Louis' necessity to present himself as endowed with absolute power and therefore owing nothing to anybody is exemplified by the medal he ordered to be struck to celebrate Cassini's discovery of the satellites of

Saturn. Interestingly, Cassini's name is nowhere to be found on that medal. Instead, the discovery was attributed to the 'learned men whom the King maintained at the Observatory'. Through this erasure of the individual author and his replacement with an anonymous collective identified only in terms of its dependence on the Roi Soleil, Louis was represented as the ultimate author (in the sense of source of legitimation) of the discovery. The medal's audience was expected to perceive Cassini and the other academicians not as free authors but as Louis' agents. The erasure of Cassini's name is not a sign of royal unfairness but rather of Louis' *noblesse oblige* toward himself.[69] In a sense, being the absolute ruler, he has to represent himself also as the 'absolute author'. The erasure of Cassini's name was a matter of royal etiquette.[70]

What is new about the French scenario is that – although the usefulness of the sciences was an unlikely prime cause for Louis' establishment of the Académie – he eventually happened to reap technical benefits from it. By contrast with the small Italian princely states, the construction of the prince's power-image in France was not at odds with the solution of state technological and bureaucratic problems, but actually merged with it. The establishment of the Académie may have been a largely image-oriented gesture, yet that institution eventually turned out to be useful because France was large and centralized enough to make use of a corps of scientific and technical specialists.

This coincidence between image and utility was, I think, not accidental. In fact, a state (large and centralized) that could use the technical services of an institution like the Académie was precisely a state (large and centralized) that could allow its king to develop a representation of his power as absolute. In turn, this type of royal image was one that would make the establishment of the Académie an image-smart gesture. In short, an institution like the Académie des Sciences fitted perfectly into the programme of state control and centralization that allowed Louis to rule as the absolute king he represented himself as being.

Let me now suggest how the analysis of Louis XIV's patronage of science may be brought to bear on the late seventeenth-century Italian scenario.

AN ACADEMY *IN INCOGNITO*

Prince Leopold de' Medici's sponsoring of what is usually considered Europe's first academy of experimental science may seem to contradict my previous claims about the unsuitability of Italian princely patronage for the institutionalization of science.[71] I will try to show that the

existence of the Accademia del Cimento between 1657 and 1667 does not subvert the previous analysis but supports it.

As noticed by several historians, Leopold never provided his academy with a legal charter. He called it into session or suspended its activity whenever he desired. He set its experimental agenda, paid for the experimental apparatus from his own purse, and tended to draw his academicians from mathematicians and philosophers who were already on the Medici payroll. It seems that the very name of 'Accademia del Cimento' was a retrospective invention connected to the publication, in 1667, of the *Saggi* – a book presenting a selection of experiments conducted at the (by then) defunct academy. Finally, the academy was neither formally established nor disbanded. It began to meet around 1657, slowed down its activities after 1662, and stopped convening after 1667 when Leopold became cardinal and moved temporarily to Rome. As one academician remarked, the academy was nothing more than an expression of the 'prince's whims'.[72]

The Cimento's status as an unofficial academy was, I think, a direct result of Leopold's participation in it. A prince of Leopold's rank could easily taint his image by working together in an *official* context with his subjects (some of whom were of quite low social background).[73] Things were made even more complicated by the Cimento's commitment to experiments, that is, to a practice involving the use of mechanical devices. People of high social status could *observe* such activities only within settings that provided appropriate 'status shields'. An appropriate etiquette had to be followed. For instance, in the Bolognese public anatomy lessons analysed by Ferrari, a secret compartment was built into the anatomy theatre so that 'authorities, ladies or other persons' could watch the mechanically-connoted dissection without being seen.[74] People of higher social status could be polluted by much less. Pope Gregory XV could not participate openly even in a semi-private academy gathered in the Vatican Palace by the cardinal nephew to listen to orations on biblical subjects. As reported by an observer, the pope 'participated' only *in incognito*, 'remaining retired in a small chapel' attached to the cardinal's room where the gathering took place.[75]

Leopold controlled the possibilities of status-pollution in various ways. First, as shown by the preface to the *Saggi*, he tried to make sure he would be perceived as a princely supervisor rather than an active hands-on participant. Second, he presented the academy as something belonging to his private sphere.[76] In fact, a prince could display himself naked to his servants in the privacy of his bath, but he could not do so in a more public space. Therefore, the participants to the Cimento could not become 'academicians' in the sense of being members of an official corporate body. Leopold's status required them to be his 'scientific servants'. In fact, they were not allowed to display their association to the academy by using titles such as 'Accademico del Cimento'. They had no official relationship with Leopold except as his subjects.

The same issues of status that made Leopold keep the academy as a fully private enterprise prevented him from entering into scientific disputes. In fact, disputes belonged to people who had an axe to grind – like members of the ignorant and self-interested lower classes.[77] The academy's vocal commitment to the experimental method – one that led to accurate descriptions of experimentally (re)produced effects rather than to the explanation of their causes – was not only a result of Leopold's desire to keep clear of possible conflicts with theologians: it reflected the politeness of the philosophical etiquette to which he was bound by his own status.[78]

By having his 'academicians' perform and describe experiments rather than seek their causes, Leopold made sure that the activity of the Cimento would not lead to status-tainting disputes. For analogous reasons, Leopold was exceedingly cautious of having himself invoked as the judge in scientific disputes. When that happened – as with Huygens and Fabri on Saturn's rings – he passed the matter to his academicians. They were instructed to perform careful experiments and, without passing any final judgement, to report what their experiments (based on *models*) suggested about the tenability of the contenders' claims (which the Cimento considered only as *hypotheses*).[79]

Similarly, in the *Saggi* (the text through which the Cimento 'went public' in 1667) Leopold made sure that the academy's activity was represented as having unrolled as smoothly as possible, undisturbed by internal disputes. The frequently strong tensions and explicit disagreements recorded in the academicians' private correspondence were made invisible in the *Saggi*. Moreover, the book was written in a collective voice. No voice of any academician, except that of the Secretary who wrote the report, is ever made explicit. On several occasions, the text's cautiousness to avoid signs of individual authorship went so far as to try to 'objectify' the narrative by adopting the passive of the third person singular ('it was taken', 'it was seen', 'it was thought', 'it was provided').[80]

There is more to the connection between the book's voice and Leopold's status than his attempt to present the academy as a haven of consensus and a space where only non-disputational knowledge was produced. For instance, it is significant that Leopold did not try to publicize his academy by opening up its meetings to many qualified

visitors (as the London's Royal Society tended to do), but by distributing (without selling[81]) an elegantly illustrated book presenting a selection of its experiments.[82]

By doing so Leopold was probably trying to kill two birds with one stone. Through the *Saggi*'s textual strategies he managed to efface himself sufficiently from the academy's activities to preserve his princely status and yet not enough to delegitimize the academy's results. Unlike Robert Boyle and the Royal Society who bound themselves to certify knowledge through 'competent' and 'open' witnessing managed through a fairly intricate etiquette,[83] the Cimento's results were presented as credible simply because they had been certified by somebody of Leopold's status.[84]

Because of Leopold's effaced but effective presence, the *Saggi* did not need to reproduce the names of the witnesses and experimenters nor any other specific circumstantial information about the execution of the experiments. In general, the *Saggi* presented neither complete reports of individual experiments nor the 'typical' experiment, but a collage-like narrative composed by various narrative segments taken from different experiments – a procedure that would have not met the strict requirements of what Shapin has called Boyle's 'literary technology'.[85]

In a sense, the present and yet invisible Leopold was the *incognito* certifier of the academy's work. But, because the *Saggi* did not mention any academician in particular, the credit for the work of the academy fell by 'default' on the prince. Leopold became the author *in absentia* – the only way in which he could be an author and enhance (rather than jeopardize) his image. The Cimento's unnamed academicians resemble Boyle's technicians studied by Shapin. They were indispensable as *workers*, but were not legitimate enough to 'make knowledge', that is, to be *authors*.[86] However, unlike Boyle, Leopold did not utilize the academicians' involvement in the experiments to blame them for possible failures. This was not a result of Leopold's good nature but of his very high social status. No embarrassing failure could be represented in a princely experimental narrative.[87] To Leopold, any such accident was equivalent to an embarrassing etiquette blunder at court.

Unlike Boyle, Leopold had the writer of the *Saggi* give his subjects full credit for having *performed* the experiments. However, despite the apparent differences, there is an underlying similarity between Leopold's and Boyle's textual strategies. For instance, in Boyle's case, the assistants were represented as nameless and unable to produce knowledge because it was the patron who had to be presented as the author. It was Boyle who had the status and credibility necessary to 'make knowledge'. The assistants 'collaborated' with him only in the sense that they took care

of mechanical tasks that could not be dealt with by somebody of Boyle's status. Leopold's case was different and yet structurally homologous to Boyle's. Having a higher status than Boyle, Leopold was bound to a lower threshold of pollution.[88] Consequently, he could not present himself as participating in scientific activities as much as Boyle could. It was because of this that Leopold's academicians received more credit than Boyle's assistants. However, giving some credit to the academicians did not deprive Leopold of authorship. In fact, because his academicians–subjects were kept nameless and because Leopold was the ultimate source of the academy's credibility, the credit reverted to the prince. Leopold was an author in the only way he could be one: *in incognito*. The peculiar voice of the *Saggi* provided a skilful solution to a problem of etiquette: to allow Leopold to fashion himself as author while remaining unpolluted by the status-tainting features of the knowledge-making process.

The namelessness of Leopold's academicians may reflect the same dynamics of princely power-image that led to the replacement of Cassini's name on the medal celebrating his astronomical discoveries with the 'learned men whom the King maintained at the Observatory'. More generally, one may suggest that the anonymity of some of the early published works of the Académie des Sciences should not be seen just as a sign of allegiance to a Baconian ideal, but may be seen also as reflecting the logic of the image of its royal patron.[89] Symmetrically, the Royal Society's acceptance of the individual authorship of their members may also have reflected the English king's lesser involvement and interest in that institution. That the Royal Society as an institution could dissociate itself from the views of its individual members may be read also as a sign of its relative independence from the king.[90] Because of the relative 'distance' between the king and the Society, his image was not directly at stake in its members' printed work. This estrangement of the royal patron, I think, made it possible for the fellows to emerge as individual authors. For individualism to emerge, the absolute monarch had to go.

This analysis has mapped out some of the specific status dynamics that governed Leopold's relationship with the Cimento and has suggested how similar dynamics may have framed the notion of scientific authorship in other European scientific institutions, but it has not addressed explicitly what Leopold's motives may have been in gathering and sponsoring an experimental academy. Practical usefulness and national technological development do not seem to have been a high-priority concern for Leopold – a junior prince of a small and increasingly agricultural state. Nor could spectacle have played much of a role in Leopold's decisions. Although the activities of the Cimento were

rhetorically presented as the heritage of Galileo's science, they could not compare with the spectacularity of his discoveries.[91] As indicated by the *Saggi*, the subject matter of the academy's investigations belonged to the category of *curiosità* rather than *meraviglie*.[92]

The Cimento's activity suited Leopold's image because its experimental discourse (like that of Boyle's experimental philosophy) presented a non-contentious type of knowledge – one appropriate to a prince of post-Reformation Italy. Moreover, the Cimento's activities were quite well suited to the codes of courtly *sprezzatura*. No sweat-inducing machines (like air-pumps) but plenty of elegant glasswork (frequently destroyed during the experiments with truly aristocratic nonchalance) populated its experimental space. Moreover, several of the 'experiences' were not produced in the academy's various meeting places, but observed in the field. They resembled botanizing and collecting (or courtly *conversazioni*[93]) as much as laboratory practices.

Academicians used the artillery pieces of the fortress of Livorno (not operated by themselves but by low-class gunners) to prove Galileo's claims about the parabolic trajectory of projectiles. They stayed up at night somewhere in Palazzo Pitti (probably in courtly late-night gatherings like those described in the *Book of the Courtier*) watching the formation of elegant ice crystals in water containers. On other nights, they busied themselves determining the speed of sound by watching the flare of faraway guns and measuring the time it took to the sound of the firings to reach them.[94] Therefore, the experiments of the Cimento were not part of a 'laboratory life'. Rather, they resembled those courtly activities – like dancing or fencing – that characterized the daily life of a prince. The meetings of the Cimento did not demarcate a modern professional space but took place in the private sphere of the prince. As shown by the sometimes very frequent and unscheduled meetings, its activities were closely connected to the varying schedule of Leopold's daily life. He called its meetings as he would have called a hunting expedition.[95]

That the Cimento did not meet regularly and never received a legal charter was not a sign of Leopold's casual attitude (on the contrary, he was exceedingly orderly and a great organizer) but rather of his status. A fixed schedule and a statute would have been an intolerable restriction of his freedom.[96] To engage in something like the Cimento, Leopold had to keep it as something completely private. It needed to be something that was perceived to be completely his own, something he could fully control and display his power and status by controlling.

At the same time, because of its private character, this setting would provide him with an 'informal' space in which he could participate in

(and legitimize) the academy in ways which would have been impossible if the Cimento had happened to be an official institution. In fact, had the Cimento been an official body, Leopold would have had to behave according to the strict etiquette that regulated the public life of a prince like himself – an etiquette that would have prevented him from mingling with technicians. The textual strategies of the *Saggi* reflected similar concerns: they conveyed Leopold's familiarity with (and yet distance from) the Cimento. Those techniques were the textual analogues of the informal formality that surrounded the activities of the academy.

These considerations suggest a relationship between privateness and publicness, participation and distance. Leopold's example indicated that a junior prince could participate in scientific activity only if this was presented as a strictly private enterprise. The case of Louis XIV suggested that an absolute monarch's public involvement in science could be only accompanied by his not participating in the scientific activities he was publicly legitimizing and supporting. In fact, Louis XIV visited the Académie at the Observatory only once, in 1682, during a purely ceremonial event. From the available evidence, it does not seem that Charles II – the king of England who chartered the Royal Society in 1662 – ever visited that institution.[97]

Leopold's concern with fitting his academy into the codes of country life is confirmed by his attention to the literary style of the *Saggi*. First of all, it is telling that he selected Count Lorenzo Magalotti (a sophisticated *virtuoso* and *letterato*) rather than Giovanni Borelli (his most brilliant but not-so-polished academician) as secretary of the academy and writer of the *Saggi*. Then, when the manuscript of the *Saggi* was finally completed, Leopold made sure it was reviewed for the elegance of its style as much as for the accuracy (and religious orthodoxy) of its scientific content.[98] Also, Leopold must have been concerned with the potential tediousness of the *Saggi* since – halfway through the text – Magalotti felt compelled to include a disclaimer about the necessary dullness of the description of the experiments.[99] Because of his status and culture, Leopold could not quite accept the apparent pedantry of Boyle's 'literary technology' without worrying about his own image.

To conclude, I think that the case of the Cimento does not contradict the analysis of the relationship between princely image and the patronage of science outlined earlier in this paper. Although the type of scientific patronage embodied by the Cimento was very different from Cosimo II's patronage of Galileo and from Louis XIV's establishment of the Académie des Sciences, it shared in the image and power dynamics that framed those other two cases. Everything in the Cimento (methodology, 'research programme', experimental activity, organization,

etiquette and public representation) was closely tied to the necessities of Leopold's status.[100] In short, the Cimento was not the toy of a rich, provincial, junior prince tired of the occupations of court life. Whatever our evaluation of the science done by the Cimento, it exemplifies the structural features of Italian princely patronage of science at the end of the seventeenth century. Because Italy's political scenario (from the small size of the states to the princes' power-image dynamics) could not accommodate the institutional formats that were developing in other European countries, and because a discipline like astronomy was becoming less spectacular than it had been at the beginning of the century, there were fewer options for social bricolage between the resources of individual scientific practitioners and those of the princely patrons. The Cimento and the other informal academies developed around Roman cardinals and prelates were among the few venues within that scenario.[101]

CIVILITY AND OBJECTIVITY: AN HYPOTHESIS

Although Boyle has been mentioned often in this essay, my narrative has ignored England – the country in which the Scientific Revolution is represented as having reached its culmination. Such a gap is not accidental but reflects this paper's focus on the relationship between the Scientific Revolution and political absolutism – a feature of the emerging modern state that was not prominent in England after 1642. Although this is not the place for a (much needed) comparative analysis of the relationship between political discourses and the legitimation of early modern science in continental Europe and England, I want to suggest ways in which the development of experimental philosophy in England may reflect status dynamics like those encountered with Galileo, the Cimento and the Académie des Sciences.

Unlike France and Italy, England displayed less pronounced social and disciplinary hierarchies.[102] In particular, the mercantile classes had a relatively larger socio-political role there than on the continent. Then – although during the Restoration royal power tried to develop absolutist traits – the seventeenth-century English kings never managed to develop a power comparable to that of the French absolute monarchs. Consequently, the English royal court was not the cultural and political centre it was on the continent, and court society was not the synonym of 'le monde'. Coffee houses, gentlemen's salons, craftsmen's workshops, professional corporations like the Royal College of Physicians, and quasi-private scientific academies like the Royal Society were England's

scientific sites. The typology of the Royal Society's membership, its funding and its programme mirrored the English socio-political scenario very closely.[103]

In such an environment, scientists were not primarily concerned with tuning their activities to the codes of patronage of an absolute prince. First of all, the need of major leaps in social status in order to overcome received disciplinary hierarchies was not felt as acutely in England as elsewhere on the continent. Moreover, the king was not the crucial source of legitimation as he was in the rest of Europe. Although the monarch played an important role in legitimizing the Royal Society by granting it a royal charter, his financial support and input into the Society's programme was minimal. The status and image of the gentleman rather than of the absolute monarch was the source of socio-cognitive legitimation sought by the practitioners of the Royal Society.[104]

Consequently, in England (as opposed to the Italian courts) a scientific practitioner did not need to be spectacular. Galileo might have remained unemployed there.[105] Although the Royal Society needed to inject some spectacularity in its experimental practices not least to sustain its membership, the type of spectacle produced there was more a matter of gentlemanly *curiosity* (though possibly a philosophically relevant one) than princely *magnificentia*.[106] Because of this environment, low-key, technical, and potentially 'boring' (in the Boylean sense) work was not only acceptable but eminently legitimate. Boyle's 'literary technology' may have seemed pedantic to continental courtiers yet, because of the English political and religious scenario, it would appeal to the English *virtuosi*. Actually, by drawing on the specific features of the English socio-cultural context, Boyle could turn the tables and equate being 'showy' to being 'unethical'.[107]

However, I would suggest that Boyle's potentially boring 'literary technology' and the complicated ceremonial that regulated the Royal Society's meetings reflected processes not unlike those that framed Galileo's princely representation of his scientific discoveries, the private nature of the Cimento, or Louis' establishment of the Académie des Sciences.[108] The different scientific discourses and institutional structures that we encounter in these cases are reflections of the different types of socio-political order (and related venues for social legitimation) that characterized late seventeenth-century England, France and Italy.

Consider a crucial difference between the English and Italian scientific styles. As shown by Steven Shapin and Simon Schaffer, the English experimental philosophers' strategies for cognitive legitimation were much less aggressive than those of Galileo. In particular, while Galileo

built a career partly on his spectacular duel-*like* exchanges with other philosophers and mathematicians, Boyle condemned such activities and put forward a form of scientific discourse aimed at preventing 'philosophical duels': kinds of behaviour he saw as philosophically sterile and socially disruptive.[109]

However, we can detect some homology beneath the conspicuous differences between Galileo's and Boyle's scientific discourses. Boyle tuned his programme for experimental philosophy to the English socio-political context by presenting his polite solution to the problem of scientific knowledge as closely linked to the political politeness necessary to the maintenance of social order – an issue of great political concern after the Civil War.[110] Galileo's tactics in representing his astronomical discoveries as fitting the Medici's dynastic mythology, and his engaging in spectacular courtly disputes, reflected a similar perception of the possibility of legitimizing the new science by playing the codes of *raison d'état* as embodied, in this case, in court culture.

In short, the very different argumentative styles of Galileo and Boyle may be traced to the different political power structures of Italy and England at that time. Although with the development of political absolutism real duels became prohibited both in Italy and France, duel-*like* fictional performances such as tournaments, jousts and *barriere* were very common and well-received within court culture.[111] When safely kept in the domain of *fiction* or courtly *spectacle*, the duel was perceived as an acceptable and even honourable 'social trope'.[112] In fact, while reminding the courtiers of the (sometimes mythical) knightly roots of princely power, duel-like performances provided aristocrats with a courtly tool for sublimating their aggressive, knightly drives.[113] In short, duel-like performances were not seen as threatening to the absolutist ruler and they actually helped him domesticate (Elias would say 'civilize') the formerly politically threatening feudal lords.

This may explain why Galileo's aggressive, duel-like scientific disputations were not seen as impolite or improper by the sophisticated audiences of the Florentine and Roman courts as, by contrast, they would have been in England. Galileo's performances were welcome and rewarded because – as shown by Cosimo II's attitude during the dispute on buoyancy of 1612 – they were perceived as akin to theatrical plays.[114] Similarly, in publishing his texts, Galileo tended (or was pressed) to use fictional genres like the dialogue (among imaginary or real but deceased actors) or 'soft' genres like the letter and the discourse. By doing so, his frequently harsh attacks on the adversaries *could* be represented as not being real challenges leading to real (philosophical) duels. Evidently, I am not saying that Galileo thought of his work as a philosophical

comedy. On the contrary, the trial of 1633 showed how strongly he believed in the reality of the Copernican cosmos. More simply, I suggest that Galileo's textual strategies provided his patrons with a safety valve through which they could prevent putting their honour on the line and having to be defended as a result of their client's engaging in philosophical duel-like tournaments. If necessary, they could regard Galileo's texts or performances as 'carnivalesque' challenges rather than *ex-professo* statements.[115]

On the other hand, in England, which had just undergone a bloody civil war and where royal power was slowly restoring itself, duel-like behaviour was likely to be perceived as socio-political anathema. Unlike continental absolute rulers, English monarchs were far from being so secure on their thrones as to turn potentially threatening social tropes into domesticated courtly games that ended up confirming their power. That was a trick only well-established absolute princes could pull. Once seen in this context, Boyle's duel-preventing experimental philosophy appears as reflecting English Restoration *raison d'état* as much as Galileo's duel-like courtly scientific performances incorporated the discourse of Italian political absolutism.[116]

One may also try to push this hypothesis further and try to relate the differing English and continental notions of scientific authorship and facts to those countries' different socio-political structures and discourses. As we have seen, the different role of the sovereign in legitimizing the scientists' practices tended to set the conditions of possibility of scientific authorship. To use a spatial metaphor, the 'distance' between the sovereign and his 'scientific subjects' tended to frame the latters' ability to present themselves as knowledge-producing authors. For instance, the prince's relative 'closeness' to his practitioners tended to prevent them from being represented as legitimate *individual* authors. Such a scenario could result either from a junior prince participating in the subjects' scientific practices (as in the case of Leopold) or from a powerful absolute monarch (Louis) legitimizing them at a distance but linking his image and honour to their activities. In both cases, the prince's investment in the scientific activities of his subjects tended to render them 'nameless'. As has been noted, the effacing of the scientific authors was a matter of princely etiquette.

Although Galileo was far from being represented as a nameless author, his case may fit this model too. True, Galileo was a conspicuous individual author but, as we have seen, his princely patrons had the option to represent his arguments as spectacles or fictional narratives. In short, his closeness to the prince did not produce an effacement of his authorial individuality (as in the case of the Cimento and, to a lesser

extent, of the Académie) but it tended to 'efface' his claims. In fact, the effacement of the scientific author or the fictionalization of his claims were etiquette-bound strategies reflecting a common goal: the need to preserve the honour of the princely patron; this, in turn, legitimized the scientist's activity.[117] In England, on the other hand, where the sovereign was relatively 'far' from his scientific subjects and did not constitute the fundamental source of the legitimation of their knowledge-claims, the practitioners could claim some level of *individual* authorship of *non-fictional* knowledge.[118]

To summarize, the scientific practitioner had to be 'close' enough to the source of legitimation in order to be perceived as credible, reliable, etc. However, the 'closer' (and potentially more legitimate) one became, the more one's individual authorship tended to shrink as the prince's power and honour became increasingly implicated in the client's claims. Ultimately, the practitioner might either be absorbed by the black hole of princely power and lose his name and authorship or see his arguments represented as fictions.[119]

However, the practitioners could not select the optimal blend of legitimacy and authorship and then locate themselves at the desired 'distance' from the prince. Far from being unlimited, the practitioners' options were framed by the specific socio-political power structures surrounding them. And, as shown by the different scenarios provided by England, France and Italy, the space where one could be a legitimate author was framed differently by different political power structures.

What is particularly original and significant about the English case is that the king's reduced power and role in legitimizing scientific practices produced a social space in which different forms of scientific etiquette could he articulated. Or, to put it differently, because the 'pull' of prince-centred legitimation was lower in England than elsewhere, a wider and less 'tense' social space was provided in which one could manage to be both an individual and a legitimate author. Experimental philosophy was a scientific etiquette that happened to develop in and reflect this specific social space.

Because the king's honour was not directly at stake in their claims, the members of the Royal Society could represent themselves as authors and their knowledge claims as non-fictional. They produced 'matters of fact', not philosophical comedies. However, this does not mean that they were able to produce knowledge 'freely'. Simply, a different but equally serious set of constraints had resulted from the replacement of the honour of an absolute prince with that of many gentlemen as the source of legitimation of scientific authorship and knowledge. Experimental philosophy was the apparatus of scientific etiquette through which Boyle

managed to negotiate these new constraints in ways that could allow for the production of legitimate knowledge claims.

On the continent, knowledge claims and scientific authors could be represented as fictional or nameless so as not to threaten the prince's honour and not to undermine their ultimate source of legitimacy. Because a gentleman's honour was lower than that of an absolute prince (though still perfectly legitimate by English standards), the *virtuosi* could produce non-fictional knowledge claims. In short, that they could make non-fictional claims resulted from their higher threshold of 'pollution' which in turn resulted from being less 'honourable' than an absolute monarch. However, although the English *virtuosi* could produce non-fictional knowledge claims, they could not be dogmatic, that is, they could not present their claims as rigidly unnegotiable.[120] Dogmatic claims would have undermined the process of knowledge legitimation by threatening the honour of those who were supposed to legitimize these claims: the other gentlemen.

The necessity of casting claims in ways that would prevent 'philosophical duels' from developing among *virtuosi* was particularly strongly felt because the gentlemen's honour was less powerful at legitimizing knowledge than that of an absolute prince and, consequently, *virtuosi* needed to 'group together' in order to produce publicly legitimate knowledge. Not surprisingly, although the experimental philosophers were real authors, they needed to rely on each other to certify what they had done. *They could be legitimate individual authors only in so far as they were members of a gentlemanly corporation* (like the Royal Society).

To summarize, while the Cimento and Galileo could be represented either as *nameless authors* or as producers of *fictional claims* as a result of their reliance on the status of one *individual absolute prince* in order to legitimize themselves and their knowledge, the English *virtuosi* could represent themselves as *individual authors* producing '*matters of fact*' because they relied on the social status of a *corporation of gentlemen* as the source of the legitimation of their knowledge.

More precisely, to use Elias' terminology, the Royal Society was a 'figuration' of *interdependent* authors. The etiquette-like dimensions of experimental philosophy and of the Royal Society's protocols of corporate interaction resulted from the need to regulate this interdependence in constructive ways, that is, by making sure that nobody's honour would be threatened by the process of knowledge certification.[121]

The striking difference between Galileo's aggressive style and Boyle's polite one is a result of the different contexts framing the 'civilizing process'. Boyle's experimental philosophy was polite because it aimed at constituting (and depended on) a community of interdependent

knowers. Galileo's aggressive style, by contrast, reflected an authorial identity fashioned by an absolutist court where he was perceived and rewarded as a producer of court spectacles – spectacles that had to be both duel-like in accordance with the codes of court culture and fictional so as not to embarrass or threaten his patron's honour. Although Galileo's scientific discourse was polite by Florentine or Roman court standards, it was informed by an etiquette much different from the one that structured Boyle's experimental philosophy. Galileo's etiquette was prince-oriented while Boyle's was targeted at an interdependent group of gentlemen and *virtuosi*.

It is in this context that we may understand the etiquette dimensions of Boyle's notion of 'matter of fact'. As has been noted, the experimental philosophers could not make knowledge claims that threatened the honour of those who were supposed to engage in the collective process of their legitimation. One had to produce honour-friendly claims without 'softening' them, that is, without turning them into fictions. Boyle's matter of fact was a type of empirical claim that could solve this problem. Matters of fact were non-threatening and yet non-fictional. However, we should not perceive matters of fact merely as 'lower' or 'reduced' forms of empirical claims. The success of Boyle's programme did not result from watering down or fictionalizing empirical claims but by tying their production (their 'fashioning') to the codes of gentlemanly identity. Matters of fact were neither *weak* nor *fictional*: they were *civilized*. True, matters of fact were *produced*, but the modalities of their production were homologous to those structuring the social constitution of gentlemanly identity, that is, of the source of social and cognitive legitimation. Self-fashioning was world-fashioning.[122]

In short, by engaging in experimental philosophy, gentlemen fashioned matters of fact as they were fashioning themselves as gentlemen. Or, to put it differently, matters of fact were 'disciplined' statements that *incorporated* a collective scientific etiquette in their very constitution. Matters of fact did not 'insult' anybody because everybody was supposed to have co-operated (actually or virtually) in their production.[123] And it was by not threatening the honour of anybody and by involving everybody legitimate in the process of their fashioning that matters of fact became legitimate, that is, that they became 'objective' knowledge.[124] Etiquette, then, was the common key to the production of both civility and objectivity.[125]

To conclude, the difference between the scientific styles of Boyle, Galileo and the Cimento may reflect the different political power structures that *framed their conditions of legitimacy*.[126] Although Italy and England displayed different political power structures, the *processes of*

legitimation connecting scientific styles to political power structures were, I think, quite comparable. In particular, I have suggested that the legitimation of one's identity and knowledge claims necessitated some source of status, credibility, honour, power. However, the stronger the power/honour one tapped into to legitimize one's identity and knowledge claims, the greater the danger of it backfiring and 'erasing' either the claim or the author.

Because of the analogy between these processes and those of courtly and gentlemanly self-fashioning, I have used the term 'etiquette' to refer to the protocols through which one interacted with the power/honour one needed to legitimize one's claims and identity while avoiding false steps that might trigger its backfiring. I hope to have shown that different political power frameworks allowed for the articulation of different types of scientific etiquette. As a result, the fundamental tension between the need to legitimize power/honour and the need to control its possible backfiring were articulated by different etiquettes in different countries. However, not all these different scientific etiquettes managed to survive. Some disappeared with the political systems that had framed them. That today's scientific practices resemble Boyle's scientific etiquette more than Galileo's suggests that modern Western political systems resemble seventeenth-century parliamentarian England more closely than granducal Florence or papal Rome.

NOTES

Thanks to Roger Hahn, David Harden, Nancy Salzer, Michael Segre, Steve Shapin, Jay Tribby, Norton Wise, and especially Julian Martin for their comments and to Paula Findlen for all the useful references.

1 I will try to use the footnotes as some sort of fragmented bibliographical essay. Although *Isis*' Critical Bibliography remains the best general bibliographical source, a more comprehensive survey of works on the history of Italian science can be found in Massimo Bucciantini and Anna C. Citernesi (eds.), *Bibliografia italiana di Storia della Scienza*, (Florence).

2 For reasons that will become apparent in the course of the argument, the scope of this essay is quite narrow. It does not consider (or claim to put forward arguments applicable to) a wide range of disciplines and practitioners. Instead, it focuses only on scientific practices supported by the state or by princely patrons.

3 Norbert Elias, *The Court Society*, (New York, 1983), *Power and Civility*, (New York, 1983) and *The History of Manners*, (New York, 1983).

4 This view goes back at least to the eighteenth century (Paolo Frisi, *Elogi* (Livorno, 1774). I have used the reprint (Rome, 1985), pp. 92, 170–1). Through the subsequent casting of Galileo as the emblem of Italian free-thinking, lay Italian culture has helped solidify this historiographical picture (Pietro Redondi, *Galileo eretico*, (Turin, 1983), pp. 407–9).

5 On the historiographical trope of the 'scuola galileiana', see Ugo Baldini, 'La scuola galileiana', in Gianni Micheli (ed.), *Scienza e tecnica, Annali* III, (Turin, 1980), pp. 383–8 [This volume is part of Ruggiero Romano and Corrado Vivanti (eds.), *Storia d'Italia*]. Among the more recent historiography of seventeenth-century and early eighteenth-century Italian science, see Michael Segre, *In the Wake of Galileo*, (New Brunswick, N.J., 1991); *idem*, 'Science at the Tuscan Court, 1642–1667', in Sabetai Unguru (ed.), *Physics, Cosmology and Astronomy* (Dordrecht and Boston, 1991, 295–308; Ugo Baldini, 'L'attività scientifica del primo settecento', in Micheli, *Scienza e tecnica*, 467–545; Clelia Pighetti, *L'influsso scientifico di Robert Boyle nel tardo '600 italiano* (Milan, 1988); Mario dal Pra *et al.*, *Le edizioni dei testi filosofici e scientifici de '500 e del '600* (Milan, 1986); Claudio Manzoni, *I cartesiani italiani* (Udine, 1984); G. Arrighi *et al.*, *La scuola galileiana: prospettive di ricerca* (Florence, 1979); Marta Cavazza, *Settecento inquieto* (Bologna, 1990); *idem*, 'Bologna and the Royal Society in the Seventeenth Century', *Notes and Records of the Royal Society* 35 (1980), 105–23; Bruno Basile, *L'invenzione del vero* (Rome, 1987). See also Paolo Casini's various works on the reception of Newton in Italy. More recent literature on seventeenth-century Italian science is given in later footnotes.

6 John Russell, SJ, 'Catholic Astronomers and the Copernical System after the Condemnation of Galileo', *Annals of Science* 46 (1989), 365–93.

7 Albert Van Helden, 'The Telescope in the Seventeenth Century', *Isis* 65 (1974), 38–58; Maria Luisa Righini Bonelli and Albert Van Helden, *Divini and Campani: A Forgotten Chapter in the History of the Accademia del Cimento* (Florence, 1981) (published as a supplement to the 1981 issue of *Annali dell'Istituto e Museo di Storia della Scienza*).

8 On the work of electricity in early modern Italy, see John Heilbron, *Electricity in the Seventeenth and Eighteenth Centuries* (Berkeley, 1979), pp. 180–208. For bibliographical references on seventeenth-century medicine see: Guido Panseri, 'Medicina e scienze naturali nei secoli XVI e XVII', in Micheli, *Scienza e tecnica*, 343–80.

9 See Maurizio Torrini, *Tommaso Cornelio e la ricostruzione della scienza* (Naples 1977); Fabrizio Lomonaco and Maurizio Torrini (eds.), *Galileo e Napoli* (Naples 1987) (especially the essays by Olmi, Galluzzi, Torrini, Palladino and Borrelli); Corrado Dollo, *Filosofia e scienze in Sicilia* (Padua 1979); Maurizio Torrini, 'L'Accademia degli Investiganti. Napoli 1663–1670', *Quaderni storici* 16 (1981), 845–81; Silvio Suppa, *L'Accademia di Medinacoeli* (Naples 1971); W. E. Knowles Middleton, 'Science in Rome, 1675–1700, and the Accademia Fisicomatematica of Giovanni Giustino Ciampini', *The British Journal for the History of Science* 8 (1975), 138–54; Lina Montalto, 'Un Ateneo internazionale vagheggiato in Roma sulla fine del sec. XVII', *Studi romani* 10 (1962), 660–73. However, the spread of scientific activities over the peninsula did not reflect a permanent pattern. By the eighteenth century, most Italian scientific centres were in the north, along the Turin-Bologna-Venice axis. On the decline of science in the south see Giuseppe Galasso, 'Scienze, istituzioni e attrezzature scientifiche nella Napoli del Settecento', in *L'Età dei Lumi. Studi storici sul settecento europeo in onore di Franco Venturi*, (Napoli, 1985), 193–228.

10 Heilbron, *Electricity* pp. 101–14, 180–208; *idem*, 'Science in the Church', *Science in Context* 3 (1989), 9–28; Maurizio Torrini, *Dopo Galileo. Una polemica scientifica (1684–1711)*, (Florence, 1979); C. Costantini, *Baliani e i Gesuiti* (Florence, 1969); Ugo Baldini, 'La Chiesa e le scienze. La scienza gesuitica', in Micheli, *Scienza e tecnica*, 513–26. See also the sizeable literature on the scientific activities of Father Athanasius Kircher in Rome.

11 Baldini, 'L'attività scientifica del primo settecento', pp. 532–3.

12 For a different but related reading of the crisis of Italian science, see Baldini, 'La scuola galileiana', p. 437.

13 According to the ambassadors from Lucca, the grand duke's income was as high as 1.5 million *scudi* around 1590, but it fell to 800,000 around 1625. Amedeo Pellegrini (ed.), *Relazioni inedite di ambascatori lucchesi alle corti di Firenze, Genova, Milano, Modena, Parma, Torino* (Lucca, 1901), pp. 124, 153. On the decline of Florentine economy in this period see Paolo Malanima, *La decadenza di un'economia cittadina* (Bologna 1982).

14 Ferrara did not even last that long. By 1598 it was annexed to the Papal State, and what used to be the site of an elegant court which just a few decades earlier had hosted, among others, Ludovico Ariosto, quickly decayed to the status of a provincial city.

15 It is quite ironic that it was at the command of Zaccaria Sagredo (the brother of Galileo's close friend Giovanfrancesco) that, in 1630, the Venetian army was badly defeated during the Italian episode of the Thirty Years' War – an event that marked the eclipse of Venice's role in European politics. It was from the battlefield at Valeggio that – just before this historical debacle – Zaccaria wrote to Galileo authorizing him to use Giovanfrancesco's name in the *Dialogue on the Two Chief World Systems*. Galileo Galilei, *Opere*, (ed. Antonio Favaro, Florence, 1890–1909), XIV, pp. 95, 97. Soon afterward, the Venetian army collapsed and Zaccaria was so fast in retreating from the battlefield that his army could not keep up with him. He arrived at the Peschiera camp four hours ahead of his soldiers. See Maria Francesca Tiepolo, 'Una lettera inedita di Galileo', *La cultura* 17 (1979), p. 66.

16 Jan De Vries, *The Economy of Europe in an Age of Crisis, 1600–1750* (Cambridge, 1976), pp. 26–7.

17 Galileo, *Opere*, XI, p. 170.

18 Silvio A. Bedini, 'The Galilean Jovilabe', *Nuncius* 1 (1986), 30–6; G. Vampaemel, 'Science Disdained: Galileo and the Problem of Longitude', in C. S. Maffioli and L. C. Palm (eds.), *Italian Scientists in the Low Countries in the Seventeenth and Eighteenth Centuries* (Amsterdam, 1989), 111–29.

19 Francis Haskell, *Patrons and Painters* (New Haven, 1980), pp. 146–53, 187–90.

20 However, France was not the only focus of emigrating Italian artists. For instance, others opted for England, *ibidem*, pp. 192–9.

21 'Eloge de Monsieur Cassini', in Bernard de Fontenelle, *Eloges des academiciens* (The Hague, 1740), I, 273–312 (esp. pp. 296–7). The parallel between the migrations of Bernini and Cassini can be pushed further. Both of them were at the centre of Louis XIV's academic projects. Cassini – together with Huygens – was treated as the foreign star of the emerging Académie des Sciences. Although Louis was eventually unable to keep Bernini in Paris, he was at least

able to convince him to open (in 1666) the French Academy in Rome; Haskell, *Patrons and Painters*, pp. 188–9.

22 G. Uzielli, *Cenni storici sulle imprese marittime e coloniali di Ferdinando I, Granduca di Toscana* (Florence, 1901), and Furio Diaz, *Il Granducato di Toscana* (Turin, 1976), pp. 280–363.

23 Edward Goldberg, *Patterns in Late Medici Art Patronage* (Princeton, 1983); *idem*, *After Vasari. History, Art, and Patronage in Late Medici Florence* (Princeton, 1988).

24 On the financial decline of the Roman baronage see Carlo Mistruzzi, 'La nobiltà nello Stato Pontificio', *Rassegna degli Archivi di Stato* 23 (1963), 206–44, and Jean Delumeau, *Vie économique et sociale de Rome dans la seconde moitié du XVI^e siècle* (Paris, 1959), 1, pp. 153–5, 434–8, 467, 471–2. The Accademia dei Lincei has attracted much attention and the resulting bibliography is too vast to be reduced to a few references. Enrica Schettini Piazza's *Bibliografia storica dell'Accademia Nazionale dei Lincei* (Florence, 1980), pp. 21–72, lists most of the relevant (though not the most recent) literature.

25 The first university-connected botanical gardens were established in Padua and Pisa in 1545. Within a few decades they spread to other countries: Leiden (1577), Paris (1590) and Oxford (1621). On the early Italian botanical gardens see Margherita Azzi Visentini, 'Il giardino dei semplici di Padova: un prodotto della cultura del Rinascimento', *Comunità* 34 (1980), 259–338; *idem*, *L'Orto Botanico di Padova e il giardino del rinascimento* (Milano, 1984); Carlo Maccagni, 'Le raccolte e i musei di storia naturale e gli orti botanici come istituzioni alternative e complementari rispetto alla cultura delle università e delle Accademie', in Laetitia Boehn and Ezio Raimondi (eds.), *Università, accademie e società scientifiche in Italia e in Germania dal cinquecento al settecento* (Bologna, 1981); Giuseppe Olmi, 'Le scienze naturali nella prima età moderna', in Gian Paolo Brizzi (ed.), *L'università a Bologna* (Bologna, 1988), 141–52.
The anatomy theatre in Padua was built between 1584 and 1594; Ferrara's in 1588; Pisa's before 1569, and Pavia's before then. Bologna built its first permanent anatomy theatre shortly after 1595, but had been using temporary ones for some time. On anatomical theatres see Giovanna Ferrari, 'Public Anatomy Lessons and the Carnival: The Anatomy Theater of Bologna', *Past and Present* 117 (1987), 50–117; A. Favaro, 'L'insegnamento anatomico di G. Fabrici d'Acquapendente', in *Monografie Storiche sullo Studio di Padova* (Venice, 1922); and G. Richter, *Das anatomische Theater* (Berlin, 1936).
On the *capitani di parte* see Giorgio Spini (ed.), *Architettura e Politica da Cosimo I a Ferdinando I*, (Florence, 1976). On the history of mathematics-based technological practices in early modern Italy, see the indexed bibliography in Mario Biagioli, 'The Social Status of Italian Mathematicians, 1450–1600', *History of Science* 27 (1989), 69–95.

26 Biagioli, 'Italian Mathematicians', pp. 42–56.

27 Mario Biagioli, 'Galileo the Emblem Maker', *Isis* 81 (1990), 230–58.

28 Peter Dear, '*Totius in verba*: Rhetoric and Authority in the Early Royal Society', *Isis* 76 (1985), 145–61; Steven Shapin and Simon Schaffer, *Leviathan and the Air Pump*, (Princeton, 1985), esp. pp. 58–9, 66; Steven Shapin, 'The House of Experiment in Seventeenth-Century England', *Isis* 79 (1988), 373–404; Mario Biagioli, 'The Anthropology of Incommensurability', *Studies in History and Philosophy of Science* 21 (1990), 183–209. See also Robert Westman's article listed in the next footnote.

29 Robert Westman, 'The Astronomer's Role in the Sixteenth Century: A Preliminary Study', *History of Science* 18 (1980), 105–147; *idem*, 'The Copernicans and the Churches', in David Lindberg and Ronald Numbers (eds.), *God and Nature* (Berkeley, 1986), 76–113; *idem*, 'Proof, Poetics, and Patronage: Copernicus' Preface to De Revolutionibus', in David Lindberg and Robert Westman (eds.), *Reappraisals of the Scientific Revolution* (Cambridge, 1990), 167–205.

30 Biagioli, 'The Anthropology of Incommensurability'.

31 Richard S. Westfall, 'Scientific Patronage: Galileo and the Telescope', *Isis* 76 (1985), 1–31; Westman, 'The Astronomer's Role'; *idem*, 'Proof, Poetics, and Patronage'; Bruce Moran, 'Christoph Rothmann, the Copernican Theory, and Institutional and Technical Influences on the Criticism of Aristotelian Cosmology', *Sixteenth Century Journal* 13 (1982), 85–108; Biagioli, 'Galileo the Emblem Maker'; *idem*, 'Galileo's System of Patronage', *History of Science* 28 (1990), 1–62; *idem*, *Galileo Courtier* (1992).

32 On this topic, see R. K. French, 'Berengario da Carpi and the Use of Commentary in Anatomical Teaching' and V. Nutton, 'Humanistic Surgery', in A. Wear, R. K. French and I. M. Lonie (eds.), *The Medical Renaissance of the Sixteenth Century* (Cambridge, 1985), 42–74 (esp. pp. 46–8) and 75–99 (esp. pp. 84–95). See also Nancy Siraisi, *Medieval and Renaissance Medicine* (Chicago, 1990), pp. 78–114, 153–86.

33 This provides a further analogy between the predicament of Galileo and those who, like Vesalius, wanted to legitimize investigative anatomy. Both of them wanted to 'take over' the cognitive status of the superior discipline (philosophy and medicine) while, at the same time, distancing themselves from their low-status colleagues (applied mathematicians and surgeons). In a sense the socio-professional hybrid proposed by Galileo (the 'philosophical mathematician') shares much with the figure (proposed by Vesalius) of a surgeon who (by developing an investigative surgery) wants to 'take over' the domain of the higher discipline (medicine). The disciplinary tensions between the physicians who taught anatomy from texts and the surgeons who were expected to demonstrate the physicians' claims through the dissected body are beautifully recorded in the discussions/challenges between Vesalius and Curtius during the former's visit to Bologna to perform an anatomy; Ruben Ericksson (ed.), *Andreas Vesalius' First Public Anatomy at Bologna, 1540: An Eyewitness Report* (Uppsala and Stockholm, 1959), esp. pp. 273.

34 Another homology between mathematicians and surgeons may be found in the strategic use of humanism so as to represent their discipline and profession as having Classical (i.e. legitimate) ancestors. Compare, for instance, the strategies discussed by Nutton in 'Humanistic Surgery' and my analysis of some mathematicians' use of Archimedes in 'Italian Mathematicians', pp. 56–67.

35 On the intricate debate over the authorship of the Fabrica's plates and on the relationship between Vesalius and John Stephen, see William Ivins, 'What About the "Fabrica" of Vesalius?', in S. W. Lambert *et al.* (eds.), *Three Vesalian*

Essays (New York, 1952), 45–99; A. Hyatt Mayor, *Artists and Anatomists* (New York, 1984), pp. 97–115.

36 On the link between the social legitimation of anatomy and the anatomists' reference to tropes of court culture see Daniel Brownstein's 'The Production of Anatomical Meaning', a paper delivered at the Northern California Renaissance Association Meeting, Spring 1990, to be included in his forthcoming dissertation, 'Revealing Anatomy: Anatomists and the Medical Space in Italy, 1520–1640', University of California, Berkeley. On Vesalius' pictorial strategies see also Glenn Harcourt, 'Andreas Vesalius and the Anatomy of Antique Sculpture', *Representations* 17 (1987), 28–61. Harcourt's argument is somewhat different from but commensurable with the one presented here. He stresses the connection between Vesalius' anatomical illustrations and Classical sculptures as a way of overcoming the connotation of anatomy as a discipline whose knowledge was rooted in routine violation of bodies. Although I am more concerned with anatomy's low social status because of its mechanical connotation rather than because of its image as a body-violating image, I think that the evidence presented by Harcourt supports my point as well as his.

37 Vesalius published a much shorter, smaller, and less expensive *Epitome* for students' use. It was also published, as the *Fabrica*, in 1543. Illustrations from the *Fabrica* are reproduced in J. B. de C. M. Saunders and Charles D. O'Malley (eds.), *The Illustrations from the Works of Andreas Vesalius of Brussels* (New York, 1973).

38 On Vesalius see C. D. O'Malley, *Andreas Vesalius of Brussels* (Berkeley, 1964). For a survey and bibliographical references on the Padua school of anatomy see Giuseppe Ongaro, 'La medicina nello Studio di Padova e nel Veneto', in G. Arnaldi and M. Pastore Stocchi (eds.), *Storia della cultura veneta*, III, pt. 3 (Vicenza, 1981), 75–134. On anatomy at Bologna see G. Martinotti, *L'insegnamento dell'anatomia a Bologna prima del secolo XIX* (Bologna, 1911). On anatomy at Pisa, see A. Corsini, *Andrea Vesalio nello Studio di Pisa* (Siena, 1915). On the continuing tensions between surgeons and physicians around the teaching of anatomy at the beginning of the eighteenth century, see Elena Brambilla, 'La medicina del settecento: dal monopolio dogmatico alla professione scientifica', in Franco Della Peruta (ed.), *Malattia e Medicina*, *Annali* VII (Turin, 1984), 5–147 (esp. pp. 5–15).

39 Pierre Bourdieu, *Distinction* (Cambridge, Mass., 1984).

40 Gerrari, 'Public Anatomy Lessons', pp. 76, 81, 89–90. On the Padua botanical garden as a tourist attraction, see Azzi Visentini, 'Il Giardino dei Semplici di Padova', p. 268. On the botanical gardens of Pisa and Florence as symbols of Medici power, see Paolo Galluzzi, 'Il mecenatismo mediceo e le scienze', in Cesare Vasoli (ed.), *Idee, istituzioni, scienza ed arti nella Firenze dei Medici* (Florence, 1980), p. 196.

41 Ferrari, 'Public Anatomy Lessons', pp. 50–106, esp. 97.

42 Confirming the close relationship between institutionalization and socio-disciplinary status, Ferrari argues that the establishment of the theatre of anatomy at Bologna in the 1590s was also tied to the awareness that temporary theatres (something that Bologna had been using until then) had become

'something of a stain on the honor of a discipline that by this time had gained a fine reputation', *ibidem*, p. 72.

43 *ibidem*, p. 66–74, esp. 72–3. Ferrari quotes Aranzio, a Bolognese teacher of anatomy and surgery, as saying in 1586 that: '... I should no longer depend in any way on the scholars, but should recognize as patrons only the distinguished senators; it was therefore concluded that I should be inscribed in the roll of anatomy, and thus insured, and freed from the election of the scholars.' *ibidem*, p. 68. Although this quote dates nine years before the project of the theatre, it lays out very explicitly the anatomists' stakes in the establishment of a city-controlled theatre of anatomy.

44 On dissections as spectacle, see *ibidem*, pp. 56–9, 82–93, and Brownstein, 'The Production of Anatomical Meaning'.

45 André Graindorge to Pierre-Daniel Huet (19 May 1665), quoted in David S. Lux, *Patronage and Royal Science in Seventeenth-Century France* (Ithaca, 1989), p. 40. The translation is Lux's.

46 Michael Lynch has put forward a similar claim about the fate of laboratory rats in 'Sacrifice and the Transformation of the Animal Body into a Scientific Object: Laboratory Culture and Ritual Practice in the Neurosciences', *Social Studies of Science* 18 (1988), 265–89. For related considerations, see also Stefan Hirschauer, 'The Manufacturer of Bodies in Surgery', *Social Studies of Science* 21 (1991), 279–319.

47 These issues maintained a crucial importance later on with the development of experimental philosophy and of experimental sites where only so-called legitimate witnesses would be admitted. On seventeenth-century experimental spaces see Steven Shapin, 'The House of Experiment in Seventeenth-Century England', *Isis* 79 (1988), 373–404.

48 Ferrari, 'Public Anatomy Lessons', p. 52.

49 Baldessarre Castiglione, *The Book of the Courtier*, Book II, ch. 11.

50 Paula Findlen, 'Museums, Collecting, and Scientific Culture in Early Modern Italy' (Ph.D. dissertation, University of California, Berkeley, 1989); *idem*, 'The Economy of Scientific Exchange in Early Modern Europe: Italy', in Bruce Moran (ed.), *Patronage and Institutions* (forthcoming); Giuseppe Olmi, 'Ordine e fama: il museo naturalistico in Italia nei secoli XVI e XVII', *Annali dell'Istituto Storico Italo-Germanico in Trento* 8 (1982), 105–81; *idem*, 'Alle origini della politica culturale dello stato moderno: dal collezionismo privato al "Cabinet du Roi"', *La cultura* 16 (1978), 471–84; *idem*, Ulisse Aldrovandi: scienza e natura nel secondo cinquecento (Trento, 1976). See also Dario A. Franchini *et al.*, *Scienza a corte. Collezionismo eclettico, natura e immagine a Mantova fra rinascimento e manierismo* (Rome, 1979); Gigliola Fragnito, *In museo e in villa* (Venice, 1988); Giorgio Fulco, 'Per il "museo" dei fratelli Della Porta', in Maria Cristina Cafisse (ed.), *Rinascimento meridionale e altri studi* (Naples, 1987), 105–175; Oliver Impey and Arthur MacGregor (eds.), *The Origins of Museums* (Oxford 1985), pp. 5–28; Aimi Antonio, Vincenzo De Michele and Alessandro Morandotti, *Musaeum Septalianum: una collezione scientifica nella Milano del seicento* (Milan, 1984); Maristella Casciato, Maria Grazia Iannello and Maria Vitale (eds.), *Enciclopedismo in roma barocca. Athanasius Kircher e il Museo del Collegio Romano tra Wunderkammer e museo scientifico* (Venice, 1986); Adalgisa Lugli,

Naturalia et mirabilia (Milan, 1983); *idem*, 'Inquiry as Collection', *RES* 12 (1986), 109–124; Krzysztof Pomian, *Collectionneurs, amateurs et curieux. Paris, Venise: XVI^e–XVII^e siècle*, (Paris, 1987). On recent anthropological interpretations of collecting and museums, see James Clifford, *The Prédicament of Culture* (Cambridge, Mass., 1988), pp. 215–51, and George Stocking (ed.), *Objects and Others*, (Madison, 1985).

51 The classic text on gift exchange is Marcel Mauss, *The Gift* (New York, 1967). On the role of gift exchange in early modern science see Biagioli, 'Galileo's System of Patronage', pp. 18–25 and Findlen, 'The Economy of Scientific Exchange'.

52 Findlen, 'Museums, Collecting, and Scientific Culture', p. 390.

53 Biagioli, 'Galileo's System of Patronage', pp. 38–41.

54 Biagioli, 'Galileo the Emblem Maker', pp. 253–4.

55 *Ibid.*, pp. 232–6.

56 Thanks to their royal status and to the dynastic theogony-style mythologies they had developed since the mid-sixteenth century, the Medici could (mythologically) represent themselves as being linked to the 'other gods' of the cosmos. Such a self-representation was not available to the nobility and patriciate. Natural history collecting and the museum were activities and spaces more appropriate to their status. Galileo's discoveries (as he had represented them) were 'above their heads'. Through the museum – a space perceived as an encyclopaedic picture of the entire world – the gentlemen could still represent themselves as being 'in touch' with the cosmos. However, the connection that the museum was able to establish between the collector and the cosmos was a 'generic' one. The macrocosm-microcosm analogy was one that fitted anybody and nobody in particular. In a sense, all museums were pictures of the cosmos. Instead, Galileo had managed to establish a *personal* relationship between the Medici and Jupiter.

57 This argument is informed by Pierre Bourdieu's work on the dynamics of social distinction as present in his *Distinction*, esp. pp. 11–96.

58 That the vast majority of Italian active foreign members of the Royal Society during the late seventeenth and the eighteenth centuries were physicians seems to support this point (Marie Boas Hall, 'The Royal Society and Italy, 1667–1795', *Notes and Records of the Royal Society* 37 (1982), 63–81; p. 70).

59 Galileo's inability to produce exceptional discoveries on a routine basis was not necessarily a liability. Although this may have prevented the Medici from developing an astronomical observatory, the very rarity of court-fitting astronomical discoveries, that made science's institutionalization unappealing to the Medici, provided Galileo with the possibility of an exceptional career by presenting his exceptionally rare discoveries as eminently 'exclusive' – that is as fitting the codes of taste of an absolutist prince.

60 However, one may argue that Louis XIV's recruitment of Huygens to Paris to direct the newly-founded Académie des Sciences in 1666 may also be a result of the high international visibility he had gained through his work on Saturn's system.

61 On the debate on Saturn's rings, see Albert Van Helden, 'The Accademia del Cimento and Saturn's Ring', *Physis* 15 (1975), 244–59. On astronomical discoveries after 1650 see *idem*, 'The Telescope in the Seventeenth Century'.

62 In fact, as shown by Margaret Jacob, Newton's philosophy gained an emblematic significance for a socio-religious group (the 'latitudinarians'), not for an absolute prince; *The Newtonians and the English Revolution, 1689–1720* (Ithaca, 1976). See also Julian Martin, 'Explaining John Freind's *History of Physick*', *Studies in History and Philosophy of Science* 19 (1988), 399–418.

63 Roger Hahn, *The Anatomy of a Scientific Institution: The Paris Academy of Sciences, 1666–1803* (Berkeley, 1971), pp. 1–57; Alice Stroup, *A Company of Scientists* (Berkeley, 1990), pp. 46–61, 103–16, 169–79. For a recent interpretation of Louis' support of science, see Roger Hahn, 'Louis XIV and Science Policy', in David L. Rubin (ed.), *Sun King: The Ascendancy of French Culture during the Reign of Louis XIV* (Washington, 1991), 195–206.

64 Actually Gian Domenico Cassini, after having discovered two additional satellites of Saturn in 1671–2, quickly realized that the number of known planets and satellites (fourteen) matched Louis' dynastic order. Although the king appreciated the 'gift', he did not go out of his way to demonstrate his gratitude to Cassini, who was not even mentioned in the medal that was struck in 1686 to commemorate the event; I. B. Cohen, 'G. D. Cassini and the Number of the Planets', in Trevor H. Levere and William R. Shea (eds.), *Nature, Experiment, and the Sciences* (Dordrecht and Boston, 1990), 199–205.

65 Louis Marin, *Portrait of the King* (Minneapolis, 1988), pp. 121–37. Louis Marin's work has informed several aspects of the analysis of political absolutism presented here.

66 Jean-Marie Apostolides, *Le Roi machine* (Paris, 1981), esp. ch. 2, 'L'organization de la culture', and Rubin, *Sun King*.

67 The observatory's monumentality reflected Colbert's plan (never quite fulfilled) that it would serve as the headquarters of the Académie – it was supposed to become Louis' 'House of Solomon'. On the conflicts between the architect Perrault and the astronomer Cassini, see C. Wolf, *Histoire de l'Observatoire de Paris de sa fondation à 1973* (Paris, 1902), pp. 19–27. That the observatory was actually perceived as a monument is confirmed by Wolf who writes that: 'Avant même que la construction du grand bâtiment fut terminée, l'Observatoire devint un but de promenade pour les seigneurs et les dames de la Cour...', promenades that flattered Cassini but disrupted his working schedule (*ibidem*, p. 115).

68 Actually, such representations may have been counter-productive in that they may have implied that Louis was in need of that type of legitimation.

69 Cohen, 'G. D. Cassini and the Number of the Planets', p. 204. See also n. 63.

70 See also n. 89.

71 The standard sources on the Accademia del Cimento are: Giovanni Targioni Tozzetti, *Notizie degli aggrandimenti delle scienze fisiche accaduti in Toscana nel corso di anni LX del secolo XVII* (Florence, 1780; repr. Bologna, 1970); W. E. Knowles Middleton, *The Experimenters* (Baltimore, 1971). See also the very insightful article by Paolo Galluzzi, 'L'Accademia del Cimento: "gusti" del principe, filosofia e ideologia dell'esperimento', *Quaderni storici* 16 (1981), 788–844.

72 Galluzzi, 'L'Accademia del Cimento', p. 823.

73 For brief biographical sketches of the participants to the Cimento, see Knowles Middleton, *The Experimenters*, pp. 26–40. On Antonio Uliva – the most 'picturesque' of the academicians – see Ugo Baldini, *Un libertino accademico del Cimento: Antonio Uliva* (Florence, 1977).

74 Ferrari, 'Public Anatomy Lessons', p. 80.

75 Venceslao Santi, 'La Storia nella *Secchia Rapita*', *Memorie della Reale Accademia di Scienze, Lettere, e Arti in Modena* 3:9 (1910), pp. 263–4.

76 This, in fact, is how Leopold was presented in the preface to the *Saggi*; Giorgio Abetti and Pietro Pagnini (eds.), *L'Accademia del Cimento* (Florence, 1942), p. 85.

77 Shapin, 'The House of Experiment', pp. 395–9. The concern with the development of a gentlemanly discourse of science is one of the leitmotifs of Shapin and Schaffer, *Leviathan and the Air Pump*.

78 Abetti and Pagnini, *L'Accademia del Cimento*, pp. 83–7, 124. See also my 'Galileo's System of Patronage', pp. 36–8. An analysis of the relationship between scientific discourses that do not search for ultimate causes and the political discourse of absolutism as embodied in court culture is presented in my 'Courtly Comets', ch. 5 of *Galileo Courtier* (Chicago, 1992).

79 Van Helden, 'The Accademia del Cimento and Saturn's Ring', *Physis* 15 (1975), 244–59. A similar attempt on Leopold's side to get off the hook by introducing experimental protocols of evaluation rather than pass judgements on the disputants' claims is also reflected in the Cimento's involvement in the dispute between Divini and Campani on the relative quality of their telescopes; Maria Luisa Righini Bonelli and Albert Van Helden, *Divini and Campani: A Forgotten Chapter in the History of the Accademia del Cimento* (Florence, 1981).

80 In his 'Of Conversational Dispositions and the *Saggi*'s Proem', in Elizabeth Cropper (ed.), *Documentary Culture: Florence and Rome from Grand Duke Ferdinand I to Pope Alexander VII* (Florence, forthcoming), Jay Tribby has convincingly argued that this type of discourse should not be seen as reflecting a modern concern with scientific 'objectivity' but rather a paradigmatic example of seventeenth-century courtly *sprezzatura*.

81 Galluzzi, 'L'Accademia del Cimento', p. 798. That the *Saggi* could not be bought was a result of Leopold's high status. However, this also helped the credibility of the scientific work described in the volume. In fact, by not being on sale, the *Saggi* were represented as being the result of a disinterested and therefore objective enterprise.

82 Shapin, 'The House of Experiment', pp. 383–95, 399–404. That the academy's closure *vis-à-vis* non-members was related to Leopold's princely status is supported by a similar pattern we encounter in France. In fact, the Académie des Sciences (another academy founded by a prince), too, was much less open to outsiders than the Royal Society. Finally, although Leopold's academy received a few visitors, I suspect that these visits were strategically planned rather than routine events. For instance, the only documented visit to the Cimento is by the *English* ambassador to Florence – a visit that happened at a time when Leopold was trying to prove the Torricellian priority over the vacuum experiments, the prime subject matter of *Boyle*'s work. Targioni Tozzetti, *Notizie degli aggrandimenti* II, pt. 1, pp. 333–6.

83 Michael Hunter, *Science and Society in Restoration England*, (Cambridge, 1981), p. 36; Shapin, 'The House of Experiment', p. 392. As noticed by Norbert Elias, etiquette tends to become more intricate when the risks of status-pollution rise higher. Consequently, Leopold's academy's lack of a specific ceremonial reflects its private character – a context which reduced considerably the possibility of status-pollution.

84 The diary of the Accademia del Cimento presents a picture of the certification process strikingly similar to that adopted by the Royal Society. On 31 July 1662, 'The Academy met at Sig. Lorenzo Magalotti's house, about repeating some experiments that appeared most necessary to the finishing of the work that is to be printed. *All of these, when they have been made easy by practice, have to be done again in the presence of His Highness.*' (quoted in Middleton, *The Experimenters*, p. 57, emphasis mine). The procedure is very similar to that described by Shapin, in which the experiments were tried and de-bugged at Hooke's house/laboratory and then re-produced in front of the Society's certifying membership (Shapin, 'The House of Experiment', pp. 400–2). The structure of the certifying process is identical in the two cases; what changes is only the certifying persona.

85 Steven Shapin, 'Pump and Circumstance: Robert Boyle's Literary Technology', *Social Studies of Science* 14 (1984), 481–520. In 'Cooking (with) Clio and Cleo: Eloquence and Experiment in Seventeenth-Century Florence', *Journal of the History of Ideas* 52 (1991), 417–39, Jay Tribby discusses the experimental narratives of Francesco Redi and of the Cimento in terms of courtly conversation with ancient authors who had written on similar topics.

86 Shapin, 'The House of Experiment', pp. 373–404; *idem*, 'The Invisible Technician', *American Scientist* 77 (November–December 1989), 554–63.

87 Similarly – as shown by the lengthy review process of the manuscript – Leopold showed himself extremely worried about the possibility of somebody finding errors in the *Saggi*.

88 It may be that the Cimento's apparent lack of interest in building an air pump could have been related to Leopold's status. A sweat-inducing machine may have been too much for Leopold. On the devices introduced to keep sweaty operators of air-pumps out of the gaze of the aristocratic virtuoso, see Steven Shapin, 'The Invisible Technician'.

89 However, one may try to argue that Bacon's natural philosophy – having been developed by a high court official in a period in which royal power in England was moving toward political absolutism – may have reflected some of the features that would later become typical of the political discourse of continental absolutism.

The Académie's official acceptance of individually authored publications (still reviewed collectively by the Académie) took place only in 1699; Hahn, *Anatomy of a Scientific Institution*, pp. 19–20, and Léon Aucoc, *L'Institut de France. Lois, statuts et règlements concernant les anciennes Académies et l'Institut de 1635 à 1889* (Paris, 1889), pp. 87, 89. On the Académie's secretive attitudes about internal proceedings and discussions, concern with controlling the publications of academicians, and tensions resulting between these practices and the individual academicians' aspirations, see Stroup, *A Company of Scientists*, pp. 204–9. I tend to see these issues as related to the king's need to present the Académie as

'royal', that is, as his own (hence the secrecy about its proceedings). The Académie was not just another gathering. It was an official one; it involved the king's name and honour in its activities and products (hence the careful collective review, censorship, and occasional anonymity of its texts).

90 On the Royal Society's publishing policies, see Margery Purver, *The Royal Society: Concept and Creation* (Cambridge, Mass., 1967), p. 179.

91 The parallels between Leopold's policy for science and the visual arts are quite interesting. As shown by Edward Goldberg's *After Vasari. History, Art, and Patronage in Late Medici Florence* (Princeton, 1988), Leopold structured his patronage of the arts on the conscious realization that Florence (and the Medici) had played a crucial role in the development of the visual arts in Italy and Europe. Probably because Florence was now losing its role as the trend-setter in the visual arts, it was time to begin to celebrate the *history* of the relationship between the Medici and the arts. Leopold's sponsorship of Filippo Baldinucci's strictly Florence-centred monumental continuation of Vasari's *Lives of the Artists* is part of this design. The establishment of a Gallery in the Uffizi exclusively dedicated to celebrating the *artists* who had worked for the Medici (and not only their works) is another part of this programme. I think that the Cimento (and especially its *Saggi*) fit this picture very well. They are the scientific equivalent of Leopold's celebration of the Medici historical role in the development of the arts. In fact, if one remembers that the Medici had supported Galileo and Torricelli (whose experiments on the vacuum kept busy European *virtuosi* for much of the seventeenth century) it is not far-fetched to imagine that Leopold could perceive his House as having supported 'all science' in the same way they had patronized all that counted in the visual arts.

92 On this issue, see also n. 56.

93 The link between courtly science and *conversazione* has been introduced by Jay Tribby in his studies of seventeenth-century Tuscan, Italian and French courtly and gentlemanly science. On the subject, see his 'Of Conversational Dispositions and the *Saggi*'s Proem', in Cropper, *Documentary Culture*; *idem*, 'Conversing the *museo Cospiano*', forthcoming in *Rhetorica*; and *idem*, 'Cooking (with) Clio and Cleo'. On courtly science as *conversazione*, see also Mario Biagioli, *Galileo Courtier*, ch. 3.

94 Several of their 'experimental objects' had a definite high-status connotation. For instance, the academicians observed *thick gold* containers exploded by the expansion of ice, experimented with the dissolution of *pearls*, and studied the properties of *diamonds*.

95 On the Cimento as a prince-driven enterprise, see Galluzzi, 'L'Accademia del Cimento', pp. 796–7. That the Cimento was not a practitioner-driven body is made clear by the dissatisfaction with its 'research programme' expressed by some of its best members like Borelli. In particular, he was frustrated by three features of the academy. First, the academy – being bound by Leopold's concern with avoiding interpretations – was not producing interesting claims. Second, the collective voice with which it was presenting its results destroyed the authorship of its most able members. Third, the experiments were not targeted at a specific research programme (a programme that could not exist given Leopold's status-investment) but wandered in all directions or focused for too long on what Borelli perceived as irrelevant problems.

96 That calling meetings without warning was a sign of power is confirmed by Louis XIV's practices. In his memoires, he recalled calling up his ministers 'when they least expected it'. (quoted in James E. King, *Science and Rationalism in the Government of Louis XIV, 1661–1683*, (Baltimore, 1949), p. 86).

97 Judging from contemporary reports reproduced by Wolf, the Dauphin's visit to the Académie in 1677 and that of Louis in 1681 were highly ceremonial events and the royal guests did not participate in any scientific activity (Wolf, *Histoire de l'Observatoire*, pp. 117–18). See also Stroup's brief but insightful remarks on Le Clerc's engraving of the (imaginary) visit of Louis to the Académie in 1671, *A Company of Scientists*, pp. 5–8. On the Royal Society expectations about Charles II's visit, see Shapin and Schaffer, *Leviathan and the Air Pump*, pp. 31–2, and Simon Schaffer, 'Wallification: Thomas Hobbes on School Divinity and Experimental Pneumatics', *Studies in History and Philosophy of Science* 19 (1988), pp. 294–5. On the way the 'distance' between the patron and the client frames the forms of scientific discourse and their legitimacy, see Biagioli, 'Galileo's System of Patronage', pp. 36–8. I am developing this theme at greater length in my forthcoming 'Absolutism, the Modern State, and the Development of Scientific Manners'.

98 On the literary dimension of the *Saggi*, see Teresa Poggi Salani, 'Tra Accademia della Crusca e Accademia del Cimento', in V. Branca (ed.), *Letteratura e scienza* (Palermo, 1978), 519–28.

99 Abetti and Pagnini, *L'Accademia del Cimento*, p. 144.

100 For instance, his brother Ferdinand II – the grand duke – could not have adopted such a patronage strategy. In fact, although for many years Ferdinand gathered an academy resembling Leopold's, his status prevented him from giving it any public visibility. Ferdinand's academy was never represented through something like the *Saggi*.

101 W. E. Knowles Middleton, 'Science in Rome, 1675–1700, and the Accademia Fisicomatematica of Giovanni Giustino Ciampini', *The British Journal for the History of Science* 8 (1975), 138–54.

102 At least, disciplinary boundaries and hierarchies are not conspicuous categories in the historiography of English early modern science.

103 Michael Hunter, *The Royal Society and Its Fellows 1660–1700: The Morphology of an Early Scientific Institution* (Chalfont St Giles, 1985).

104 On the difficult synthesis of the roles of the gentleman and the experimental philosopher, see Steven Shapin, '"A Scholar and a Gentleman": The Problematic Identity of the Scientific Practitioner in Early Modern England', *History of Science* (1991), 279–327.

105 For instance, although the English astronomer Harriot used the telescope for astronomical observations before Galileo, he does not seem to have thought of the reward he could have received by a courtly representation of those 'marvels'.

106 On the role of spectacular experiments in maintaining the Royal Society's membership, see John Heilbron, *Physics at the Royal Society during Newton's Presidency* (Berkeley, 1983).

107 For instance, upon receiving the Cimento's *Saggi*, Oldenburg referred to it as 'the pompous book of their experiments', R. D. Waller, 'Lorenzo Magalotti in England, 1668–9', *Italian Studies* 1 (1937), p. 60.

108 The similarities between the corporate etiquette of the Royal Society and that of the House of Commons has already been noted by Steven Shapin in 'The House of Experiment', pp. 392–3.

109 Shapin and Schaffer, *Leviathan and the Air Pump*, pp. 22–79; Shapin, 'The House of Experiment'. Issues of trust, credibility, and non-disruptive, 'duel-preventing' forms of scientific discourse are being analysed by Steven Shapin in his forthcoming book, *The Social History of Truth*.

110 Shapin and Schaffer, *Leviathan and the Air Pump*, pp. 80–1, 282–3.

111 On the prohibition of duels see Richard Herr, 'Honor Versus Absolutism: Richelieu's Fight Against Dueling', *The Journal of Modern History* 27 (1955), 281–5; Frederick R. Bryson, *The Sixteenth-Century Italian Duel* (Chicago, 1938), pp. 102–3; V. G. Kiernan, *The Duel in European History* (Oxford, 1989), esp. pp. 68–96; François Billacois, *The Duel: Its Rise and Fall in Early Modern France* (New Haven, 1990), pp. 40–6, 95–105. For an interesting analysis of the transition from aristocratic views of duels to more 'civilized' ones informed by considerations of absolutist reason of state, see Giancarlo Angelozzi, 'Cultura dell'onore, codici di comportamento nobiliari e stato nella Bologna pontificia: un'ipotesi di lavoro', *Annali dell'Istituto storico italo-germanico in Trento* 8 (1982), 305–24. On the transition, in Italy, from fighting duels to talking about them, that is, to the emergence of the 'scienza cavalleresca' partly as a form of courtly conversation at the end of the sixteenth century, see Francesco Erspamer, *La biblioteca di Don Ferrante. Duello e onore nella cultura del cinquecento* (Rome, 1982), pp. 56–7, 69–73. On duel-like theatrical court spectacles, see, for instance, Alois Maria Nagler, *Theatre Festivals of the Medici* (New Haven, 1964) and Elias, *Court Society*, pp. 148–9.

112 It is important to remember that the literary genres used by the courtly Galileo tended to be *fictional*. For instance, he did not write *treatises* (a genre in which the author speaks with *ex-professo* authority and, consequently, 'gives the lie' to opponents) but worked within the fictional genre of the *dialogue* (Campanella called the *Dialogue on the Two Chief World Systems* a 'philosophical comedy'), the *discourse* (a genre in which arguments are presented and debated without reaching ultimate truths), and *letters* (addressed to a third party rather than to the interlocutor whose positions he was challenging). Similarly, in the *Assayer* – one of Galileo's most abrasive works – he did not debate against a real person but insulted a *mask* (in that debate, the Jesuit Grassi was represented as a fictional character – Lotario Sarsi). As Galileo mentioned at the beginning of the *Assayer*, by wearing a mask, one makes him/herself liable to insults because his/her real identity and status (the *sine qua non* for a challenge) become undetectable. The apparent exception presented by the two published texts where he made extensive use of geometrical propositions can be explained. One, the *Discourse on the Two New Sciences*, was published after his fall, in the Netherlands, and allegedly without his permission. The other, the *Discourse on Bodies in Water*, was largely a dialectical argument that contained only a few geometrical propositions. Its relatively dogmatic character can be seen as a result of Galileo's attempt to restore his credibility with the grand duke after he had been vocally attacked by a number of Tuscan philosophers and had been criticized by the grand duke for his impolite behaviour during the dispute. In short, Galileo was 'philosophically violent' because he had been 'given the lie' by his opponents. Nevertheless, it is interesting that his 'dogmatic' style was criticized by his friend Sagredo and by the Jesuit Griemberger.

113 It is also interesting to see that, in time, jousts and tournaments shed their aggressive features and turned into polite theatrical genres and equestrian ballets; Elias, *Court Society*, pp. 148–9.

114 Biagioli, 'Galileo's System of Patronage', p. 30.

115 Galileo's trial should not be seen as an exception to this pattern. The patron's ability to represent the client's claims as fictional should be evaluated contextually. For instance, because of his delicate political position in 1632, Urban VIII could not quite act as if Galileo's *Dialogue* were a hypothetical piece (as it was supposed to be).

116 A much more extensive and detailed comparative analysis of these issues is provided in my 'Absolutism, the Modern State, and Scientific Manners' (forthcoming in *Critical Inquiry*), and in *Galileo Courtier*, ch. 1 and Epilogue.

117 The patron's honour could be threatened in a number of ways: by binding it to knowledge claims that may turn out to be wrong; by tying it to an author whose aggressive argumentative style may be represented as a breach of polite etiquette; or – in the case of an absolute prince – by intimating that the practitioners' knowledge was produced independently from the legitimation they had received from the prince.

118 However, one could not increase the 'distance' between the practitioners and the princely source of legitimation indefinitely without delegitimizing the scientific enterprise. In fact, were the 'distance' to increase too much, then the scientific disciplines may be perceived as illegitimate, unreliable, etc., like self-interested artisans.

119 This phenomenon reflects well-known patronage scenarios. As Francesco Liberati put it in *Il perfetto Maestro di Casa*, (Rome, Bernabò, 1658), 'Lodasi però più tosto il non intrigarsi troppo co i signori, massimamemte co i Principi grandi, li quali sono simili al fuoco, che posto in debita distanza riscalda, & illumina, e troppo vicino abbrugia, e toglie la vista,' p. 9.

120 Some of these issues are analysed in ch. 2 of Steven Shapin's forthcoming book, *A Social History of Truth*.

121 Shapin, 'The House of Experiment', pp. 397–8.

122 I owe this felicitous phrase to Steven Shapin.

123 On the relationship between 'neutral facts', etiquette and objectivity, see also Lorraine Daston, 'Baconian Facts, Academic Civility, and the Prehistory of Objectivity', forthcoming in *Annals of Scholarship*.

124 By 'involving' I mean both direct and virtual involvement. Virtual involvement refers to the fact that, by resembling the ritualized forms of interaction that structured the gentlemen's lives and identities, experimental philosophy may have seemed 'natural' to them. In short, an entire culture (and not just the set of gentlemen involved in the production of one specific matter of fact) was represented in that 'scientific etiquette'.

125 Expanding on Shapin's and Schaffer's crucial but somewhat Durkheimian point that solutions to the problem of knowledge are solutions to the problem of social order, I would say that the notion of etiquette may help bring those two domains together by pointing to the process through which both knowledge and social order are produced and maintained: self-fashioning.

126 However, I am not at all dismissing the role played by England's specific socio-economic context in the development of its science. On the contrary, I believe that those considerations could be easily reconciled with the picture presented here. In fact, the specific English political structure and discourse that frames my interpretation is closely connected to the specific socio-economical scenario of seventeenth-century England.