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A Shock to the Public: Itinerant Lecturers and Instrument Makers as Practitioners of Electricity in the German Enlightenment (1740-1800)

1. Introduction

Who would dare to dispute Volta's place in the history of electricity? Even if at another conference this would be quite an impossible task. His ranking in the premier league of electricians is secure. Yet the more we "descend" from the top to the middle or even to the lower regions of electricians in the eighteenth century the more difficult it becomes to assess their contribution to the scientific and technological progress of electricity. Or, one might say, the easier it becomes to diminish or dismiss the importance of, for instance say, itinerant lecturers, instrument makers and amateur scientists. Although, of course, entirely hypothetically, one might argue that the history of electricity would have taken a different course if they had not been around.

One might correctly object that this is a teleological and therefore unhistorical argument. Yet if one browses through most of the textbooks on electricity (with an historical introduction), histories of electricity or accounts of science in the Enlightenment this is more or less what we find. They are either not mentioned or are not credited with any significant contribution. For reasons of space but even more so for reason of linearity the story that is told in these accounts tends to be reductionist and omissive.

Yet the question remains: what do we miss out by excluding more names and details? According to Thomas S. Kuhn, a lot. He argues that with the exception of England "the contributions of academicians to the Baconian physical sciences were minor compared with those of doctors, pharmacists, industrialists, instrument makers, itinerant lecturers".[1] The aim of this paper is to try and assess the significance of the latter two groups for the history of electricity. It is well known

[1] KUHN (1977), p. 52.

that there have been many itinerant lecturers and instrument makers[2] specializing in electricity from the 1740s onwards when electricity had become a fashionable science. Yet with the notable exception of England,[3] we actually know very little about these scientific salesmen,[4] in most cases not even their names, let alone their background, their careers, their self-understanding and self-fashioning, their range of activities, their social status or the problems they encountered.

There are two major reasons for this neglect.

One of them is simply the lack of relevant sources. The itinerant lecturers published little or nothing (the instrument makers usually a little more), and we find few references to them in other sources. The second reason is that their importance – at least in the traditional history of science, with its focus on institutions, concepts, disciplines and famous individuals, – has been considered rather small if not nil. Or even worse: an impediment to the progress of science. The itinerant lecturers and instrument makers did not make any major discoveries or inventions, they were – with a few exceptions – not members of an academy of science and they hardly ever taught at university. They only provided rather idle entertainment to a public with only a superficial interest in science. That is the way many members of the republic of letters and sciences saw it in the eighteenth century and we still have not questioned this view sufficiently.

To overcome this neglect both reasons have to be dealt with. First of all as many sources as possible must be located and interpreted and on that basis – maybe – the place of itinerant lecturers and instrument makers can be reassessed. Useful sources are, e.g., advertisements in newspapers, reports on electrical demonstrations and material from archives giving information on the administrative process for staging a performance at the market-place or in a pub. Furthermore the perception of itinerant lecturers and instrument makers by the "established" natural philosophers is of considerable interest in order to gather different perspectives.

[2] In my terminology itinerant lecturers and instrument makers refer to two kinds of scientific practitioners that overlap but do not coincide with each other: not every maker of scientific instruments gave lecture-demonstrations or traveled around, although many did, and inversely, most but not necessarily all itinerant lecturers made their own instruments.

[3] INKSTER (1980); MILLBURN (1976), (1983), (1985); MILLBURN and KING (1988); MONEY (1993); MORTON, (1990); SCHAFFER (1983), (1993).

[4] For the German-speaking territories there is one valuable article (RUEGER (1982)) that deals with an instrument maker from Nuremberg, Johann Conrad Guetle, who specialized in electrical instruments. HOCHADEL (2003) takes a broader look at the non-academic practitioners of electricity. With regard to France much research has been done on the Academy of Science as well as on the salon as a place for the practice of electricity and other sciences (SUTTON (1995)), while very little is known about itinerant lecturers, (see HEILBRON (1982), pp. 150-8). ROBERTS (1999) takes a close look at the different milieus of the electrical machine in the Netherlands, including the market-place.

2. An Italian Goes North: A Case Study

With few sources at hand the question is how to proceed. It is already very difficult if not impossible to estimate the total number of these scientific salesmen. Therefore I shall conduct a case study and later on try to contextualize it. In this essay I will focus on itinerant lecturers and instrument makers in the German Empire but in honor of Volta I will pick an Italian as an example. Thirteen years before Volta, in 1732, Giacomo Bianchi was born in the little village of Pognana in Lombardy beside the lake of Como. We know relatively little about his life but we would know practically nothing at all if his son had not made a splendid career as a general to the Habsburg Empire in the first half of the nineteenth century, which rewarded him with a biographer who had to cover his father also.[5]

At the age of sixteen, Bianchi is already on the road, we find him selling barometers with his brother Philipp in Augsburg at the end of 1748.[6] Then we lose track of him for a couple of years. Perhaps he went to Holland, where we know he is at least once during his life.[7] This is likely because two of his brothers, Philipp and Xaver Fidelis, had set themselves up as instrument makers in the Netherlands.[8]

Giacomo was a talented instrument maker and his capabilities in working with glass enabled him to build electrical instruments as well. But Bianchi has not only craftsmanship but also a talent for demonstrating, or some might say showmanship. In the late 1750s he becomes a successful lecturer on natural philosophy with special regard to electricity in Southern Germany. By then he has germanized his name to Jakob Bianchy or even von Bianchy, after he knighted himself.[9] In 1756 he is in Strasbourg where he makes instruments from glass and other materials for the cabinet of the university.[10] The same year he travels to Frankfurt where he is – according to himself – appointed "public lecturer of experimental physics". In Frankfurt, he offers in 1756/57 a series of lectures and promises to cover the whole range of experimental physics in 8 days, 2 hours each day. Bianchy claims that his lessons would be understandable for both the learned and the uneducated. He requires a minimum of 15 persons. Particular emphasis is put on the display of the "precious and most rare instruments and machines".[11] From Frankfurt he seems to go slowly southwards, we find traces of him in Mannheim and Karlsruhe in 1758 and 1759.[12]

What did he actually demonstrate in his lectures? A report of his activities in Swabia from 1759 mentions the following phenomena: a one-foot-long electrical spark can be drawn from the machine, an entire deck of cards as well as six eggs can

[5] HELLER VON HELLWALD (1857).
[6] *Augsburger Intelligenz-Zettel*, (1748), p. 52.
[7] BIANCHY (1762), p. 78.
[8] HELLER VON HELLWALD (1857), p. 3; ROOSEBOOM (1950), p. 30.
[9] JESINGER (1928), p. 135.
[10] HELLER VON HELLWALD (1857), p. 4.
[11] BELLI-GONTARD, (1850), pp. 101 f.
[12] BIANCHY (1763), p. 76; HELLER VON HELLWALD (1857), pp. 4 f.

be struck through, several animals are killed, butter, oil as well as gunpowder can be ignited, different metals can be melted. The list seems endless and there is hardly one trick missing which had made electricity so popular in the 1740s: the electric chime, the beatification, which makes the hair of a person "glow", the electric spider and so on and so forth.

But Bianchy also tries to demonstrate that the blood circulation is accelerated by means of electricity. All in all we find a mixture of entertainment, popularization and medical or scientific investigation. Bianchy claims that many of these "experiments" are his own invention while others are "borrowed" from famous electricians such as Divisch, Franklin or Nollet. He prints some sort of catalogue in 1759 offering nearly 100 different instruments which he mostly makes himself.[13]

In 1759/60 he teaches at the University of Tübingen for two semesters and asks at the end of the academic year for a letter of recommendation. The protocol of a faculty meeting shows that all the professors are willing to acknowledge his dexterity in demonstrations. Yet one of them objects to calling Bianchy a professor. He knows with certainty, writes the professor, that no one other than Bianchy himself has granted him this title. And because Bianchy has no form of proof he is only addressed as "clarissimus dominus" in the letter of recommendation. So the University draws a fine line between the professors of the faculty and Bianchy who is denied that academic status. The fact that all the professors mention his skill – one could interpret – highlights the fact that they considered him only skillful but not learned.[14] This was not a problem for Bianchy at the courts where he had previously worked. In those recommendations he is called a professor.[15]

From Tübingen Bianchy's way leads him south-eastwards. He gives public lectures in the small Swabian town of Nürtingen where he also cures the paralyzed hand of a soldier by means of electricity.[16] Then he goes on to teach physics in the monastery of Elching near Ulm.[17] Later he performs optical experiments for a courtly public at the residence of the Prince of Bavaria in Nymphenburg near Munich.[18] Thus Bianchy's public differs all the time: students, amateur scientists, well-off citizens, monks, noblemen. Whoever was there and willing to pay was rewarded with shocks and sparks.

At the latest in 1762 Bianchy settles in Vienna and becomes "mathematician" and "court mechanic" to the Duke Joseph Wenzel of Liechtenstein. Due to the lack of relevant sources it is not clear what this "engagement" really entails. This office apparently does not yield enough income so Bianchy devises in the next fifteen years all sorts of ideas. He continues to produce instruments. In 1763 he publishes a

[13] *Berichte* (1759), VIII, pp. 587-9.
[14] *Universitaetsarchiv* Tübingen, 32/1, Nr. 367-70.
[15] HELLER VON HELLWALD (1857).
[16] *Berichte* (1760), IX, p. 379.
[17] HELLER VON HELLWALD (1857), p. 5.
[18] BIANCHY (1763), p. 64.

sort of instrument-catalogue that includes a description of the instruments and instructions for their use.

The instruments on offer include telescopes, microscopes and other optical instruments like the magical lantern, different kinds of air-pumps, barometers and thermometers as well as an impressive range of electrical instruments: Leyden jars, electrical orreries and, of course, electrical machines, all of which are portable, fit for travel, yet still "all experiments can be done with it".[19]

He also offers certain appliances for medical electricity like an "electric infirmary chair" as well as special electrical glass balls. The idea was to put some sort of medicine into the glass ball and "disperse" it via electricity in a more effective and subtle way. This might be a bit surprising because this idea, first brought forward by some Italian electricians in the late 1740s, was successfully criticized by Nollet as ineffective and was not held afterwards.[20] Bianchy, fifteen years later, does not claim that this would be a useful method of treatment – he simply wants to offer these balls to people who want to find out for themselves if it works or not.[21] This illustrates the "theoretical richness" that prevailed in the eighteenth century when no theory had achieved a paradigmatic status in the sense that it was able to explain the phenomena sufficiently and be considered superior to all the other theories.[22] But, as the young Lessing said, the paralyzed man does not care if Nollet or Franklin or neither of them is in the right with his ideas of electricity, as long as he himself is cured.[23] For the providers of the instruments this "theoretical anarchy" rather meant an advantage because they could cater for different theories with different equipment.

Bianchy's projects in Vienna are numerous: the empress Maria Theresa grants Bianchy two patents for a fire extinguisher and a geographical handbook.[24] In 1770 he starts to publish the *Wiener Realzeitung*, which contains little news as such but book reviews and all sorts of advertisements. Bianchy apparently continues to make instruments because he offers barometer-clocks and thermometers with drawers underneath making a nice impression on the toilet-table.[25] These two-in-one pieces show that his customers were aristocrats or well-off citizens combining the fashion of the new instruments with the need for domestic display.

Yet all these projects apparently have the contrary effect: instead of yielding money Bianchy seems to lose it all. He departs from Vienna in 1777 for Paris, leaving everything behind him, including his wife Anna Maria, his four small children and a fifth on the way. In her will Anna Maria complains that her husband has spent her

[19] *Ibid.*, p. 78.
[20] SCHAFFER (1992), pp. 339-49.
[21] BIANCHY (1763), p. 89.
[22] SIBUM (1990), p. 110.
[23] LESSING (1886-1924), XII, p. 428.
[24] *Oesterreichisches Staatsarchiv, Allgemeines Verwaltungsarchiv*, Hofkanzlei, Saalbuch 214, fol. 370 and fol. 536.
[25] *Wiener Realzeitung*, Nov. 19, 1770.

entire fortune and left her nothing. In due return, she decrees, she will leave him nothing either, but will give all that is left to charity and to her children.[26] According to his son's biographer Bianchy teaches physics and chemistry in Paris, develops a blood pump and is in contact with Franklin and others.[27] If Bianchy is among all the "Professori o dilettanti di Scienze Naturali" who Volta meets during his stay in Paris in early 1782 we do not know,[28] Martinus van Marum, the famous Dutch electrician, visits him in July 1785.[29] Bianchy also works as an instrument maker again. He offers a wide range of instruments, and electrical machines are once more at the core of his production. And as he had already done in the 1750s he offers several courses in experimental physics.[30] Interestingly enough he conducts at least one of his lecture-courses in cooperation with a medical doctor: "M. Bianchi présentera l'éxpérience. M Alphonse Leroy en developpera la théorie".[31] This "job-sharing" might be interpreted as an attempt to increase the status of their proposed series of lectures. Leroy was a member of the faculty of medicine in Paris. We do not know exactly how successful Bianchy was in Paris but it seems he did not do too badly. He dies in October 1785, aged 53, in Paris.

3. The Lives and Works of Itinerant Lecturers and Instrument Makers

Bianchy's "career" exemplifies many of the facets and problems of itinerant and instrument-making life. One of his main problems was his un(der)defined status in a highly hierarchical society. Where does a mechanic and itinerant lecturer fit in here? The status of traveling people in general was quite precarious. Like musicians, artists and actors, itinerant lecturers did not have an easy time meeting suspicion and distrust everywhere they wanted to work, being processed through an administrative machine each time. In particular "itinerant Italians" with their cheap instruments of glass were considered a threat to the business of local instrument makers and were not very well respected.[32] Bianchy tries everything to raise his status: self-enobling, by calling himself "Prof. Phys. Experim" or other fancy title such as "court mechanic of the Palatine" and by collecting as many letters of recommendation as possible. That did not necessarily help as the Tübingen episode has shown. The professors there would not buy his purported academic legitimacy.

The making of electrical machinery and the demonstration of electric phenomena were not the only occupation of Bianchy. He produced other scientific instruments as well, in particular meteorological and optical ones. But he also

[26] *Wiener Stadt- und Landesarchiv*, Mag. Test. Nr. 15700 ex 1779.
[27] BIANCHY (1763), p. 9.
[28] *VE*, II, p. 94.
[29] VAN MARUM (1970), pp. 227 f.
[30] DAUMAS (1953), pp. 195 f.; HEILBRON (1982), p. 157.
[31] "Cours d'électricité", *Lecture-Announcement*, Minneapolis: Bakken Library (no year given).
[32] KOERBER (1974), pp. 274 f.; LICHTENBERG (1983-92), II, p. 303.

ventured to launch other projects that had no immediate connection to science. It is not surprising that Bianchy apparently turned away from electricity and towards other things in the 1760s and most of the 1770s. These years marked a relative low in the public interest in electricity after the first wave of enthusiasm in the 1740s and 1750s had passed. The attention of the public was revived in the late 1770s through the invention of the electrophorus, a renewed interest in medical electricity, the introduction of lightning rods on a large scale and the debate on galvanism in the 1790s.

In other words: Bianchy and other itinerant lecturers and instrument makers had to face economic ups and downs and try to adapt. For example in the 1780s when ballooning was à la mode, many electricians in Germany went into the air or at least tried to. Bianchy is typical of an itinerant lecturer and instrument maker in so far as electricity forms only part of his activities and is subject to circumstance and economic fortune. It was not unusual at all for an itinerant lecturer to travel through different countries and cultures. In order to make a living they had to be flexible and look for an audience wherever they could find one.

The (social) range of itinerant lecturers and instrument makers was quite broad so Bianchy cannot possibly represent all of them. It was, for example, rather unusual to publish as much as he did. A rather well known itinerant lecturer on electricity at the time, the Viennese Martin Berschitz never published more than a "flyer" to announce his lectures.[33] By the looks of it, Bianchy's audiences were rather "upper class", at least in the 1750s. He performed at university or even at court. Most of his fellow electricians had to stage their shows in pubs, at the market-place or in theater-like venues. Even arenas for animal-fighting were not exempted. In September 1792 two electricians from Frankfurt, the brothers Melber, tried to electrocute an ox in Vienna in such an arena.[34]

At the other end of the scale, so to speak, we find (a few) instrument makers of a much higher social status (and income) than Bianchy. Georg Friedrich Brander (1713-1783), e.g., was a founding member of the Bavarian Academy of Sciences in 1759 and his workshop in Augsburg attracted many visitors.[35] One of his customers was Volta himself, never referring to Brander without using the adjective "famoso".[36] Brander had earned his fame with his geodetic precision instruments which were well known all over Europe. When there was a sufficient demand he also produced electrical instruments: for example, at the end of the 1770s he offered for sale the electric pistol, a mixture of hydrogen and oxygen which could be exploded with an electrical spark – quite a playful and amusing gadget.[37] Yet Brander never performed electrical experiments in public nor was he an itinerant.

[33] HOCHADEL (2003), pp. 250-73.
[34] *Wiener Stadt- und Landesbibliothek*, Plakatsammlung, C 16.361.
[35] BRACHNER (1983).
[36] *VE*, II, pp. 94, 284, 502.
[37] WEBER (1779), p. 82.

4. Itinerant Lecturers, Instrument Makers and the History of Science

So let us come back to the question if these scientific salesmen were merely a circus-like troupe of artists and charlatans or if they make a worthy subject in the history of science. Let me argue in favor of the latter and mention a few points that will highlight the importance of itinerant lecturers and instrument makers.

Providers

Itinerant lecturers and instrument makers provided instruments for all kinds of private and public collections as well as for all sorts of institutions of learning, ranging from universities to secondary schools. Instructions on how to use the instruments were also available. And nearly all of them propagated the introduction of lightning rods and offered to put them up. So itinerant lecturers and instrument makers met a considerable demand for instruments and related "services" in a newly emerging market. It is very typical that Bianchy claims that his electrical machines are easy to transport and, of course, easy to use. In his instructions "research" into the phenomena is not an issue (except for medical electricity); most of them are "sociable" appliances fit to amuse or bewilder. The emergence of an "entertainment industry" relied on itinerant lecturers and instrument makers because they fabricated the hardware and demonstrated phenomena to a broad public.[38] Scientific commodities form a part of the consumer society that has its roots in the eighteenth century.[39]

Innovators

The emergence of a new market also meant competition between the different "providers", so the itinerant lecturers usually did everything to put their fellow instrument makers down. Bianchy, e.g., emphasizes that the scale of the barometer has to be divided exactly and not miscalibrated "comme le font ordinairement ces gens qui promènent & qui vendent les Baromêtres dans les rues".[40]

The competition is particularly severe in electricity because the novelty of certain show-pieces wears off fast. So the demonstrators had to think all the time of other and possibly more exciting and crowd-winning experiments. In their rhetoric they never get tired of emphasizing that they will show new tricks, never seen before. One might object that the multiplication of fancy demonstrations or the production of nicely ornamented instruments for the parlor did not contribute anything to the progress of electricity as a science but might have instead even held

[38] STAFFORD (1994).
[39] SCHAFFER (1993).
[40] BIANCHY (1758), p. 1; similar attack in BIANCHY (1762), pp. 55 f.

it up. Quite a few natural philosophers criticized itinerant lecturers – but also their colleagues at university – along these lines.[41]

There is no general answer to this objection. One would have to look at each individual instrument. In the case of Bianchy's thermometers and barometers it seems that he deserves some recognition for the accuracy of their measurements. As regards electricity, the scientific salesmen often rebuild the electrical machines of better known instrument makers and tried to "improve" them, i.e. make them stronger (length of sparks), portable, nicer to look at or simply cheaper, as was the case with Bianchy's reconstruction of Nairne's machine, which he offered for half the price.[42] For their own economic interests they tried their best to meet the demand of their customers. So the competition between the instrument makers increased the variety and availability of electrical instruments. And that is no negligible factor in the development of a branch of the physical sciences.

Spreading the Interest

Yet itinerant lecturers and instrument makers did not only make the distribution of electrical machines possible. It is not unlikely that young Johann Wolfgang Goethe, born in 1749, was in the audience when Bianchy demonstrated electricity in Frankfurt in 1756/57. Although the young Goethe failed to build himself an electrical machine from a spinning-wheel the subject matter was always part of his interest in the natural sciences.[43]

So the igniting spark for many (amateur) scientists to do research in electricity was actually coming from the electrical machine of an itinerant lecturer or a local instrument maker. In southern Germany this was the case with Joseph Weber, later to become a physics professor and inventor of the so called "air-electrophor", and with Christoph Gottlieb Bohnenberger, a pastor and passionate machine builder.[44] Both were prolific writers on electricity.

Audience(s)

Thus the audience of itinerant lecturers and instrument makers reached far beyond, let us say, that of the professor of experimental physics. The reading public learned about electricity by reading the countless reports on electrical demonstrations, electrical healing etc. in the newspapers and journals of the time. Yet, one can presume without too much speculation, that electricity was something that wanted to be seen or even felt directly, live, so to speak. Yet we have to emphasize that not virtually everyone could follow electrical demonstrations. People in the cities had

[41] LICHTENBERG (1967-72), III, p. 24.
[42] *Souscription pour la Machine Electrique de M. Nairne*, Minneapolis: Bakken Library, 1784.
[43] GOETHE (1887 ff.), I/26, p. 188, and II/11, pp. 195 f.; MENTZEL (1909), p. 110.
[44] SCHMID (1831), p. 12; BOHNENBERGER (1784), p. 5.

better chances than people in the countryside simply because the demonstrators were looking for a large public. And, not to forget, the shows were not free of charge, so one had to have the means to purchase a ticket. But even people from the lower classes had some chance to feel the discharge of a Leyden battery when they were treated with medical electricity.

Public Science, Public Demonstration

To say that itinerant lecturers and instrument makers only performed eye-catching tricks while the institutionalized scientists did the "real" research would be to misconstrue the character of eighteenth-century scientific practice. Despite being called the Age of Reason the eighteenth century is still a "visual culture". Science, and in particular electricity, was fashionable, not because it was useful but because it was entertaining. The visual character of a large part of natural philosophy is not peripheral or negligible but central to its "success", i.e. the widespread public attention. And therefore a strict dichotomy between the "playful" electricians and the "serious" natural philosophers would be completely misleading. The practice of electricity in academies and universities is often no less performative than that of itinerant lecturers and instrument makers.

It was at a session of the Prussian Academy of Sciences that a liquid, a mixture of alcohol and sulfuric acid, was ignited through an electrical spark with a sword for the first time in January 1744[45] And Georg Christoph Lichtenberg, the most famous professor of experimental physics in Germany at the end of the eighteenth century was only one of many who had to try to provide an exciting and "explosive" lecture to attract as many students as possible – to make enough money to cover the expenses for his instruments and to support himself. The average salary of a German professor was not enough and had to supplemented by lecture fees. Nevertheless these professors tend to complain about their students, who only wanted to see physics but not learn anything about it.[46] This complaint reveals a lot about the expectation of the students who only flocked to lectures if there was lightning and banging, as Lichtenberg put it.[47] This is not to level the differences between the academic and the non-academic world but to stress some parallels.

Contrast-Foil

But a professor of physics did not want to be compared with a scientific salesman. Thus itinerant lecturers and instrument makers fulfilled another function as well, rather unwillingly. In German-speaking territories at least, they served as a useful contrast for the institutionally established natural philosophers. As the professors in

[45] HEILBRON (1979), pp. 272 f.
[46] *Ibid.*, p. 16.
[47] LICHTENBERG (1967-72), I, p. 624.

Tübingen made clear, Bianchy was only a craftsman. He was very skilled in his craft but he was not a scholar with the required academic training. What Rupp says about England that "the natural philosophers distanced themselves from the learned professions as well as from instrument makers",[48] because of their low social status applies to the German-speaking territories, too. But it is not only the low social status of most itinerant lecturers and instrument makers that made the natural philosophers shy away from them. The notion of the natural philosopher was still in flux. He tried to prove his utility to society but had not too much to show for it yet in terms of applicable inventions or discoveries. He had to seriously work on his public image. And he did. One important strategy was to distinguish himself from itinerant lecturers and instrument makers who practiced electricity at the market place and in the workshop. Being a member of a university or academy of science usually invested him with institutional legitimacy. Furthermore he stressed his commitment to serious, knowledge-yielding, sometimes arduous scientific practice. He did not indulge in the useless repetition of electrical tricks which did not yield any new insights but merely pleased the senses of an uneducated public and filled the purse of the lecturer. He wanted to understand and explain electricity "scientifically".

In a letter, Lichtenberg says that Volta distinguishes himself considerably from the "common electricians". His experiments were not so stunning to the crowd in comparison to his earlier ones but very important for theory.[49] This reminds us that Volta first became known for the invention of the electrophorus and the electric pistol. The electrophorus was welcomed by many because it reduced the size of an electrical machine and made it handier![50] The electric pistol soon became very popular, instrument makers like Brander rebuild it. Yet this invention was categorized as an electrical toy.[51] So even Volta had some trouble initially in being admitted to the category of the "serious" natural philosophers.

5. Conclusions

Itinerant lecturers and instrument makers formed part of a very rich and complex culture of scientific practices in the eighteenth century. Their contribution to the "progress" of electricity is difficult to measure and cannot be given in terms of the number of inventions made or concepts developed.

But it should have become clear by now that they played a crucial role in the "electrical movement" of the Enlightenment reaching a large public, generating widespread interest in the subject matter and providing a material basis with their instruments and services. But that is not the only reason why they deserve more

[48] RUPP (1995), p. 501; see SCHAFFER (1983), p. 30, for France.
[49] LICHTENBERG (1983-92), II, p. 418.
[50] *Augsburger Staats- und gelehrter Zeitung*, 10.2.1778.
[51] GEHLER (1787-96), III, p. 508.

attention. After all, the reason just mentioned is still part of a teleological pattern which tries to explain the success story of modern science – even if we conceive of this pattern in a broader way. An even better reason for studying itinerant lecturers and instrument makers is that they enrich our understanding of eighteenth-century scientific culture per se. These scientific salesmen help us to avoid projecting our modern image of science onto the time of the Enlightenment. They defamiliarize the past and draw our attention to historical differences. Because itinerant lecturers and instrument makers are between the lines or rather exactly on the line we have since drawn to distinguish science from non-science,[52] they enable us to understand the development of modern science, the shaping and sharpening of its self-image. The above-offered alternative – these scientific salesmen as worthy object of study or circus-like troupe of artists – is possibly a false dichotomy. An electrical instrument was both a tool of research and a commodity. Playful entertainment and fruitful research, the public practice of electricity and scientific endeavor, have not always been completely different things.

[52] GIERYN (1998).

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