

Antoine de Lavoisier's role in designing a single-blind trial to assess whether 'Animal Magnetism' exists

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Introduction

In 1784, a Royal Commission was appointed in Paris to examine the claims made by Anton Mesmer and his associates that there existed a fluid – the so-called Animal Magnetism, which permeated all living creatures – manipulation of which could relieve or cure all human maladies.

Initially, five members were appointed from the Parisian *Faculté de Médecine* but, almost at once, these medical men requested that others from the *Académie des Sciences* be appointed to join them. This was done and the final Commission of nine members included a number of eminent scientists of whom at least two remain very well known, Benjamin Franklin and Antoine de Lavoisier.

Although Mesmer was willing to put his methods to the test in a controlled trial comparing his use of Animal Magnetism with orthodox treatments,^{1,2} he absolutely refused to allow tests assessing whether Animal Magnetism existed. However, a Dr Deslon (or D'Esilon), who had been an associate of Mesmer but had now parted company with him, agreed to take part in an investigation of the techniques used to apply Animal Magnetism and of its effects. He demonstrated how subjects were 'magnetised' and cooperated with the Commission in carrying out experiments to establish whether or not Animal Magnetism was, indeed, a physical phenomenon.

In the course of the investigation, which eventually proved to the Commissioners' complete satisfaction that the effects produced by the manipulations of the magnetisers were not due to any physical force, the Commission devised the first known experiments using blind comparisons to compare the effects of two treatments. In these single-blind experiments, the subjects were unaware whether or not they were being subjected to 'magnetisation' and the experimenters decided whether or not 'magnetising' was carried out.

Who designed the Commission's experiments?

In their Report,³ the Commissioners always refer to themselves as a body which thought this, considered the other, or decided to do such and such. The Commissioners are only rarely mentioned individually and never in the context of presenting an argument or proposing a course of action. Really, we have only one source of clues to the likely driving force behind the design of the experiments – some of which, those involving blind tests, were truly revolutionary. This source is the documents on Animal Magnetism preserved in the Works of Lavoisier.⁴ Remarkably, these documents seem largely to have been ignored by those who have studied the Commission's Report.

Lavoisier was executed during the revolutionary 'Terror' on 8 May 1794. In May 1795 the Convention decided to return the confiscated property of the 'Tax Farmers' (of whom Lavoisier had been one) to their heirs, and this process began the next year (1796). By the early 1840s, the French state had become very conscious that Lavoisier's execution had not only been unjust – as had been admitted within a few years of the event – but that it also reflected very badly indeed on the State's reputation. The State decided to make such amends as it could by publishing, at its expense, a complete edition of Lavoisier's works including all his remaining unpublished papers.

The six volumes eventually appeared between 1862 and 1893. Oeuvres Volume III (1865) contains a set of unpublished papers on Animal Magnetism in Lavoisier's own hand, of which the Editor says in a footnote (p. 499): 'Lavoisier collected the following pieces with the intention of publishing them; we have been obliged to follow his wishes' [*Lavoisier avait réuni les pièces suivantes, écrites de sa main, avec l'intention de les publier; nous avons dû nous conformer à sa pensée*].

All the material is interesting, but the section which is labelled 'Plan of Experiments' is the most relevant to a history of the development of controlled trials (interested readers will find an English translation of all of Lavoisier's pieces on Animal Magnetism in my ebook on the Royal Commission).

The first part of Lavoisier's Plan explains his attitude and that of the Commission to the claims of the magnetisers and is worth quoting here. Lavoisier had previously summarised Mesmer's claims and had concluded:

This simple exposé, concise as it is, shows how cleverly and with what assurance animal magnetism is presented. It is a mixture of true facts and observations with claimed results from a principle that is completely hypothetical and from this one has succeeded in creating a body of doctrine which is imposing even to enlightened doctors of medicine.

He then continues:

The skill of the Commissioners consists in following the chain of reasoning and recognising where it is interrupted; in putting facts before reasoning. A good system of logic does not allow the admission of new principles in order to explain facts if these can be explained by other principles that are already known. We shall therefore not admit [the existence of] animal magnetism except to the extent that it will present effects that cannot be assigned to any other cause. We shall investigate whether imagination alone, without magnetism, cannot produce similar [effects] and we shall undertake, therefore, a series of experiments on animal magnetism separately from imagination and on the imagination separately from magnetism. These reflections have suggested the following plan to me.

The Commissioners chosen by the king to examine the method of M. Deslon have already seen enough of it to be justified in suspecting that all the effects that it produces can be explained without introducing into physics and medicine an animal magnetic fluid of which no positive proof demonstrates the existence, and which shares none of the properties of other known fluids, and for which one supposes gratuitously some [properties] which are incompatible with others and with everything that one knows.

Note Lavoisier's comment that his reflections on how the existence of Animal Magnetism should be tested have 'suggested the following plan to me'. He then expands on the goals that the Commissioners should pursue for another couple of pages before presenting,

in a separate section, his Plan of Experiments. My English translation of the Plan can be found in the Appendix.

The Plan sets out experiments to be conducted at Benjamin Franklin's house at Passy, now a suburb of Paris but then a separate village. Experiments at Passy are described in the Commission's Report, but these are not identical to those in Lavoisier's Plan. The Plan describes an experiment, which does not appear in the Report, to be carried out with subjects seated around a pool, though the Report does include a rather similar experiment which does not involve magnetisation of water in a pool. The Report describes the now famous experiment with magnetised trees at Passy. This does not appear in Lavoisier's Plan. Lavoisier also mentions by name a subject who is not named in the Report.

For the 'Plan of Experiments', crucial questions to which we would like answers are, was the Plan drawn up in advance of the experiments at Passy and was it constructed by Lavoisier alone? It is difficult to see how the second question could be answered since, generally, the Report does not identify the contributions of individual Commissioners and, on the occasions when it does, the record is just of who did what and not of who was or were the designer or designers of each experiment; nor do Lavoisier's papers mention any contributions by other individual Commissioners.

But the contents do suggest that the Plan did, indeed, predate the experiments themselves. Comparing Plan and Report it is clear that the Commissioners did follow the principles set out in the Report although not in every detail. An experiment very similar to that proposed at a pool was carried out but, apparently, without the pool. Instead of having Deslon magnetise water beside the subjects, the Commissioners led the blindfolded subjects to believe that they were being magnetised by Deslon though, in fact, Deslon was absent. The Plan required that the subject's pulse be felt during the pretended magnetisation; the Report records that this was specifically avoided to prevent any possible claim that, by touching the subject, the experimenter had transferred magnetism to her. This suggests that the Plan was, indeed, available to the Commissioners who then decided, upon reflection, that it would be better to avoid touching the subject as was inevitable to feel the pulse, for the reasons which they explain. The subjects, believing themselves to have been magnetised though they had not been, fell into *crise*, that is, they showed the signs and described the symptoms which followed actual 'magnetisation' by Deslon or by someone using his techniques. This set of experiments described in the Report contains the 'blind' trial of 'magnetisation' against 'imagination'

explained in Lavoisier's 'Plan' but carried out without the pool of 'magnetised' water.

The 'Plan' ends with a requirement that each Commissioner be provided with a copy of his duties so that he would be quite clear what he was to do.

The Plan was prepared, one supposes, either by Lavoisier alone or in consultation with other Commissioners. Since it is very clear that the Commissioners, including Lavoisier, had reached a stage at which they strongly suspected that the effects of magnetisation were not due to a physical agent acting on the subject, and the Plan sets out experiments specifically to test this, it must have been drawn up after the preliminary observations set out in the Report.

It seems unlikely that Franklin had taken part in drawing up the plan of experiments for the day of the 'Magnetised Tree' experiments, on which the blind comparison of 'magnetisation' against 'imagination' was also performed. Bailly wrote to Franklin on Thursday 17 June (1784) about the arrangements for the visit of all the Commissioners, and Deslon, Commissioner de Bory's wife and some experimental subjects, on Saturday 19 June, the day on which the 'Magnetised Tree' experiments took place. The last paragraph of Bailly's letter to Franklin on Thursday 17th June says:

M. Bailly will present himself at Passy about ten in the morning of Saturday to inform M. Franklin about the plan of the intended experiments, and to prepare in front of M. Franklin all that is required to carry them out.

This passage is so important to the question of whether Franklin took part in devising the Plan that I quote the original here: 'Mr. Bailly se rendra a passy vers dix heures du matin samedi pour faire part a Mr. Franklin du plan d'experiences projetées, et preparer sous ses yeux tout ce qui sera necessaire pour les executer' (Franklin Papers Letter 641286, Bailly to Franklin, 17 June 1784. <http://franklinpapers.org/franklin/>).

Note the critical phrase 'pour faire part a Mr Franklin du plan d'experiences projetées...' This is not an expression that one would use if one were simply reminding the other person of something about which he already knew or of details which had been discussed with him previously. It strongly implies that the details of this plan of experiments were new to Franklin. The implication of 'sous ses yeux...' is that Franklin will be a witness that all has been prepared correctly. Obviously, it also shows that the Plan pre-dated the magnetised tree experiments and was not a post hoc account.

It is clear that the Plan pre-dated the experiments and that the experiments described in the Report as being carried out at Passy, though they followed the principles of testing the effects of 'magnetism' and 'the imagination' separately and in a blind fashion, were not identical to those set out in Lavoisier's Plan. We now have the question of when and by whom the Plan was modified. In particular, we would like to know whose idea it was to perform the blind experiment with magnetised trees. Unfortunately, we have no answer to this. That the Plan was probably modified before the Saturday of the experiments is suggested by the reference in Bailly's letter to 'the young man who has already been the subject of an experiment' whom Deslon was going to bring as well as two of his women patients. Mme de Bory (Commissioner de Bory's wife) was also going to be there. It seems that Franklin was already expecting Deslon and the 'experienced' subject but not the additional three women. Bailly's letter suggests that Franklin had agreed to Deslon's visit with the 'experienced' subject, so the question remains open of how much Franklin knew of what was intended. The Report makes clear that the tree experiment had been discussed in advance with Deslon who agreed that it should be done at Passy in Franklin's presence and that, to produce a decisive result without repetition, it required a subject who had already been demonstrated to be 'sensitive' to magnetism, whom Deslon would bring. It would seem, then, that Lavoisier's Plan had been modified to the extent of adding the tree experiment before Bailly wrote to Franklin on 17 June. But the conclusion stands, from Bailly's language, that Franklin was probably not aware of the details of the Plan, as, presumably, he would have been if he had been involved in drawing it up.

Lavoisier's contribution to the work of the Royal Commission

Because Lavoisier's 'Plan of Experiments' was prepared in advance of the experiments at Passy, it is possible that it was he who devised the ingenious experiments to separate effects of an external agent from those generated within the subject by what the Commissioners called 'the imagination'. If so, he designed what seem to be the first single-blind trials of a procedure. Lavoisier did say explicitly 'These reflections have suggested the following plan to me' [*Ces réflexions m'ont suggéré le plan qui suit. Oeuvres de Lavoisier* Tome III p. 508].

It would be delightful to be able to claim that, more than two and a quarter centuries after the event, we now know who designed the critical experiments for the Royal Commission and, in so doing,

generated the first blind trial of a procedure. Even more so, that we have identified Lavoisier as this person just by careful reading of a section of Lavoisier's memoirs which has largely been ignored. But this would be to go too far. It is difficult to doubt that Lavoisier had a major influence on the Commission, but, of course, in our complete ignorance of the content of discussions between the Commissioners it is impossible to know whether the Plan represents only Lavoisier's ideas, to which the rest of the Commission then subscribed, or was devised following joint discussion and with contributions from several individuals. But, from Bailly's letter of 17 June 1784, it does seem very unlikely that Franklin took part in drawing up this detailed Plan. The Plan reads very much as a scheme devised by a single person who was used to designing critical experiments to give unequivocal answers to clearly defined hypotheses.

I think that all that we can conclude is that, if one wished to attribute the critical single-blind experiments to one mind alone, the evidence that we have suggests very strongly that the mind would be that of Lavoisier. One cannot help wondering whether, if Lavoisier had, indeed, published his material on Animal Magnetism as his editors said was his intention, he might have claimed that he was the designer of the Commission's critical experiments.

The methodological legacy of the French trials of Animal Magnetism

Sixteen years later, John Haygarth⁵ reported a single-blind experiment using a placebo (sham) device,⁶ which is described in a pamphlet entitled 'Of the imagination, as a cause and as a cure of disorders of the body: exemplified by fictitious tractors, and epidemical convulsions'. Haygarth showed that a set of fake 'tractors' made of wood achieved similar effects on the symptoms of rheumatism as the effects which had been attributed to 'magnetic healing' using metal tractors, so called 'Perkinism'.⁷

Haygarth's report refers to the French experience 16 years earlier:

It need not be remarked, how completely the trial illustrates the nature of this popular illusion, which has so wonderfully prevailed, and spread so rapidly; it resembles, in a striking manner, that of Animal Magnetism, which merited the attention of Franklin, when ambassador from America, and of other philosophers at Paris. If any person would repeat these experiments, it should be done with due solemnity. During the process, the wonderful cures which this remedy is said to have performed

ought to be particularly related. Without these indispensable aids, other trials will not prove as successful as those which are above reported. The whole effect undoubtedly depends upon the impression which can be made upon the patient's imagination.⁶ (p. 4)

There was explicit recognition of 'placebo effects' within mainstream medicine at least as early as 1772.^{8,9} The controlled trial reported by Lavoisier and colleagues and that reported by Haygarth make clear that blinded testing of treatments to control for placebo effects had been conceptualised and implemented by the end of the 18th century.⁷

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Appendix 1

Lavoisier's Plan of Experiments. Translated from *Oeuvres de Lavoisier publiés par les soins de S. Exc. le Ministre de l'Instruction Publique. Tome III*, 1865, pp.511–513.¹⁰

Plan of experiments

We shall go to Passy, to M. Franklin's house, at exactly midday. All the Commissioners will meet M. Deslon and the subjects who are to be magnetised in M. Franklin's bedroom; there we shall explain in a definite manner that neither M. Deslon nor the other Commissioners shall say a word, except only for a single Commissioner who will question the patient.

Arrange for M. Deslon to magnetise Mme de Roumagné; M. Franklin with M. Majaud, M. Darat, Mme Moré in the salon; the Commissioners, M. Guillotin, M. Le Roy, M. de Bory, directly in the other room; M. Bailly, M. Lavoisier, M. Sallin, through the door.

Then, on the pretext of having experiments to arrange, we shall take the patients to a place in the house where they will be kept under surveillance, each in a separate room; one of them can be put in the salon. Since the object of the first two experiments is to test the effect of the imagination on people who are not magnetised, but who believe themselves to be, one can do several at once. Thus, one will be able to carry out the experiment with the pool and the one with direct magnetisation. For this purpose, two Commissioners, MM... will take one of the patients, blindfold him and take him to the pool, where the required number of chairs will have been set out. A third Commissioner will come in a few moments later, making a little noise, in such a way that the patient will be persuaded that it is M. Deslon. One of the Commissioners, M... will be charged with feeling the patient's pulse from time to time, and asking him about what he feels, remembering that the object is to make the patient believe he has been magnetised and that he ought to be feeling effects, and slanting his questions in such a way as to confirm him in this idea. Another Commissioner, M... will carefully record in writing the questions, the

replies and all the circumstances. It is important that there is only a single Commissioner who speaks. If the patient falls into a *crise* the Commissioners will have nothing to do other than to give him aid, to observe and to record.

However, one of them can absent himself to go and fetch M. Deslon if it is thought to be necessary. But M. Deslon will be required to observe the rule of silence even faced with a patient in *crise* and even if he should appear to be unconscious. On the other hand, if, after 30 min, there has been no effect, one of the two will go and find M. Deslon and get him to approach quietly, while the interrogating Commissioner distracts the patient's attention by his questions. In addition, since it is not the patient himself whom M. Deslon will magnetise, but the water in the pool, the distance can be great enough that the patient does not notice his presence.

During the same period three other Commissioners will be responsible for the experiment on direct magnetisation of another patient in the salon. M... will be the interrogator, M.... will keep the records and M.... will be charged with unaffectedly imitating M. Deslon magnetising. In this experiment all will be done that one believes most appropriate for deceiving the imagination of the patient so that he cannot doubt that M. Deslon is present. The one whose responsibility is to interrogate will use all convenient methods in his questions; he will even appear on occasions to address remarks in a low voice to M. Deslon who is magnetising, but who is required to work without replying in accordance with our rules.

A few minutes before the end of the time that has been allotted, one will say to the patient:

Look, the experiment is about to finish and we will take you back to the place where you were blindfolded, but there is one other thing to which we would like you to agree; that is, to remain for another quarter of an hour with your blindfold on so that you can examine your sensations when you are not magnetized and compare them to those that you have just experienced.

Then one will lead the patient to a room where M. Deslon will have been taken and signal to him to magnetise the patient; but it is likely that we will not have to get to that stage and that the patient will have fallen into *crise* before the end of the 30 min when M. Deslon was absent.

So that the procedures are carried out precisely, each Commissioner will take a summary of what he has to do.