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Volta: an aristocrat who had inventions

Volta: Science and Culture in the Age of Enlightenment

Giuliano Pancaldi

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About two centuries ago the Italian scientist Alessandro Volta invented the battery – a device that was to change our civilization for ever. Volta was also one of the founders of electrical science and one of the most significant figures towards the end of the Age of Enlightenment. This new book by Giuliano Pancaldi is the first serious, well documented monograph dedicated to Volta (1745-1827). With careful attention to detail, it documents Volta's fascinating intellectual and personal history.

It is not, however, a hagiographic account that concentrates solely on the extraordinary scientific results that made Volta famous. It is instead a biography that is set in the social, economic and cultural context of the Europe of the day. Volta is sketched in all his complexity, including the various characteristics of his emotional life, his attitude towards religion, as well as his scientific activity as a “natural philosopher”.

It is particularly interesting to note how Pancaldi relates the different stages of Volta's career to his personal, scientific and social endeavours to obtain recognition from the scientific community and to manoeuvre himself into public administration. The author shows how the young Volta – an aristocrat who had not attended university – quickly adopted the ideas of the late European Enlightenment. While initially a mere amateur in physical matters, he eventually became an expert in the fascinating new field of electricity. Finally, in 1778, he was appointed professor at the University of Pavia, which was then the most prestigious institution of the Austrian empire.

Pancaldi first focuses his attention on Volta as the investigator of electricity and the inventor of successful instruments. He relates Volta's systematic measurement of various electrical quantities to the more general “quantifying spirit” of the Enlightenment. Without undervaluing Volta's ambitions as a theorist, Pancaldi paints him more as an Instrumentalist - an inventor of genius who shared the practical skills of the instrument-makers whose company he enjoyed. If Volta had to work out a particular theoretical concept, it was more “operational” than abstract and was generally triggered by the results of laboratory experiments. Volta's inventions fit into a model that Pancaldi defines as “competitive imitation”.

In 1775, for example, Volta invented the electrophorus - a new kind of generator that used what we would now call “electrostatic induction”. The “invention”, however, involved nothing more than copying and improving upon apparatus that had previously been described by the German physicist Franz Aepinus. In other words, Volta turned equipment that had been conceived for complex and difficult-to-repeat experiments into a commonly used instrument.

He was prompted to do this by his skill as a demonstrator of electrical phenomena and by the Enlightenment ideal of “useful inventions”. In Pancaldi's view: the electrophorus was invented before a complete theory existed that could explain its workings. The fact that Volta described the instrument without a clear exposition of his electrical theory gives the electrophorus a life of its own, independent of the inventor. His other inventions also enjoyed a similar degree of independence.

Without doubt the most original part of Pancaldi's book is his description of the path that led Volta to invent the battery. The author shows how Volta's interest in galvanic phenomena was closely linked to the more general “hunt for weak electricity” which Volta worked on for over 10 years. Indeed, the frogs that Luigi Galvani used in his famous experiments reacted to electricity that was so weak that no instrument could register it. Volta's challenge was to “capture”, reveal and multiply this weak electricity without using frogs to reveal it.

From this point of view, the invention of the battery was a surprising victory over weak electricity, for the new instrument could move and multiply the electricity - and generate a continuous flow that had never been seen before. Pancaldi convincingly maintains that, even with the invention of the battery, the competitive-imitation model was decisive in Volta's experimental research.

In the case of the battery, what Volta had to imitate and improve upon was a piece of apparatus that had been described by the British electrochemist William Nicholson, who proposed that an electric machine should be built to imitate the action of a torpedo fish. The drawing used by Nicholson showed the electric organs of the torpedo fish as “columns” made up of several discs of different materials placed one on top of the other. Volta interpreted this picture using his contact theory, in which pairs of metallic conductors - the columns of the torpedo fish - set the electricity in motion. By connecting pairs of these metallic conductors to each other, the effects could be multiplied and reproduce the sharp shocks of the torpedo fish.

So, in the space of a few months towards the end of 1799, Volta - through “competitive imitation” of Nicholson - had invented the battery. Like the electrophorus, the battery at once took on a life of its own, independent of its inventor's ideas and aims. Indeed, the battery came to be considered a case study for the ideas and consequences of the Enlightenment. In particular, this period saw the emergence of the scientist and the partial eclipse of the natural philosopher.

Some historians will probably criticize Pancaldi for his decision to limit himself exclusively to electrical science and ignoring the other fields to which Volta made equally significant contributions, such as chemistry and pneumatics. It is difficult to deny however that this book is one of the most mature pieces of recent research into Volta. Indeed, the book is so full of suggestions, information and original ideas that it should be a compulsory reference point for anyone who wishes to examine Volta in his historical context.

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