# Introduction

*Matters at court devour my time & energies, as always. His Majesty becomes daily more capricious. At times he will forget my name, and look at me with that frown, which all who know him so well, as if he does not recognize me at all; then suddenly will come an urgent summons, and I must scamper up to the palace with my star charts & astrological tables. For he puts much innocent faith in this starry scrying, which, as you know well, I consider a dingy business. He demands written reports upon various matters, such as for instance the nativity of the Emperor Augustus and of Mohammed, and the fate which is to be expected for the Turkish Empire, and, of course, that which so exercises everyone at court these days, the Hungarian question: his brother Matthias grows ever more brazen in his pursuit of power.*

– John Banville, *Kepler*.

In the lands situated in the heart of Europe, swept by the conflicts of the early twentieth century – just as they were three centuries before, at the time of Kepler – began the life of John von Neumann, a figure who perhaps more than any other is representative of twentieth century science. Von Neumann was a brilliant scientist, the author of fundamental contributions to mathematics and theoretical physics, and he played a vital role in the extraordinary display of power of twentieth-century science, as expressed by the development of computers, automation, space travel, and the use of atomic energy.

In fact, the triumphs of science – and also its miseries – which so deeply mark our era, are actually the outcome of a long historical process that begins symbolically with the work of Galileo. After the Scientific Revolution, the role of natural philosophy in modern society thinking and life became increasingly important. Even when this role was expressed in essentially theoretical and intellectual forms – that is, without any visible practical fall-out on everyday life – scientific breakthroughs, and above all the best-known of them all, Newton's mechanics and his theory of universal gravitation, formed the most solid basis for faith in progress, typical of the Enlightenment period and later of the whole of modern thought.[1]

1) On the principle of omnipotence characterizing modern scientific thought, see Israel 2001.

The links between von Neumann's own epoch and the distant age of the birth of modern science are closer than they might seem. In the first place – despite the emergence of relativistic and even sceptical views –, because science has continued to draw inspiration from the ideal of achieving a unitary, coherent, objective and universal image of the world. And secondly because, except for a few important differences, Kepler's description of the servitude and difficulties of his life as a "scientist" also evokes the delicate role that befell the so-called "experts" or scientific advisors after World War II. Kepler was appointed imperial mathematician to the court of Kaiser Rudolph II in 1601: in view of his knowledge of astrology, his main task was to advise the emperor on the management of a wide range of personal and political matters, and to deliver his prophecies in the form of "written reports". Von Neumann, although born in Budapest, in Hungary – that European frontier land between East and West on which the concerns of Rudolph II were focused – rose to the highest rank possible for a scientist at the service of the United States government. The dramatic upheavals that began to shake Europe in the 1930s led him, like many other scientists, to move to the United States, where he became a member of the select and exclusive Atomic Energy Commission. And it may well be said that several of von Neumann's writings prompted by his government service could well be considered prophecies concerning the times in which we live.

But here the analogies cease and differences arise. Indeed, the growing role of science in society and the increasing interweaving of science and technical knowledge which, towards the end of the nineteenth century, culminated in the burgeoning of technology, allowed less scope for the figure of the scientific scholar serving as an advisor at the mercy of the "king's" whims. The Age of Enlightenment had put forward the idea that the government of society must be founded on scientific bases, and indeed it is the scientific *élite* itself who should lead society in accordance with these principles. The *Idéologues* school led by the mathematician Condorcet[2] dreamed of discovering and applying the mathematical laws that would rationally and justly regulate the making of decisions in courtrooms, in assemblies, and in elections, or else would be used to govern the economy.[3] This highly ambitious project came to nought: significatively enough, Napoleon opposed the rights of human subjectivity and history to the Enlightenment's claim to base the government of society on the principles of pure rationality.[4] Nevertheless, the seeds had been sown of a dialectics that is still

2) On these topics see Moravia 1974, 1986.

3) Condorcet was the author of a program aimed at the establishment of a "social mathematics", that is, a mathematics suitable for treating all the problems involved in managing society and the economy. In this connection, see Baker 1975, Israel 1993a, 1996b.

4) In a speech delivered to the Council of State on 20 December 1812, Napoleon Bonaparte, in the following terms, attacked the movement of the *Idéologues* and its claim to construct a science of society: «It is *ideology*, this shady metaphysics that, subtly seeking the prime causes, sets out to establish on these bases the legislation of peoples, instead of appropriating laws to the knowledge of the human heart and lessons of history, that must be blamed for all the misfortunes that have befallen our fair France. [. . .] When one is called upon to regenerate a state, it is necessary to follow constantly opposing principles. History paints the human heart: it is in history that one must seek the advantages and disadvantages of the different legislations.» (N. Bonaparte, *Correspondance*, 32

being discussed and is still unresolved. And it was on the basis of the highly developed prestige and role of science that a multi-faceted genius, with an extraordinary capacity for navigating not only the paths of science but also those of government, was given the chance to succeed, albeit in isolation, where the followers of Enlightenment had failed. Von Neumann was not only a respected government advisor but, acting in this capacity, he succeeded in communicating and even putting into practice his idea that the governance of worldly matters must be guided by a universal logic within which each individual must move in accordance with a rational strategy directed to achieve the best result, taking into account the fact that also the other individuals are pursuing the same aim.

The life and scientific activity of von Neumann may be divided into two main periods, the time before and the time after his move to the United States. These two periods correspond to widely differing scientific interests. The European period is characterized by fundamental contributions to the great scientific issues of the early twentieth century, and will be dealt with in the chapters 1 and 2 of the book. The American period instead reflects the more usual and consolidated image of this scientist: it is no coincidence that the Hungarian emigré scientist is generally referred to by the Anglicized version of his first name, John (or Johnny). In this period science attained a far-reaching influence, not only in philosophy and culture, but also in the social and economic fields, and even in politics. This was the period that saw the birth of "big science", that is, scientific practice based on large-scale research projects linked to technological development and carried out by very large groups of specialists working in different fields, in large research centres provided with highly complex equipment and infrastructures and receiving very substantial funding. Chapters 4 and 5 are devoted to the contributions made by von Neumann to this line of development. Chapter 3 aims at outlining his overall scientific outlook, which in our view was consolidated already in the early years after his move to the United States. We will then follow the unfolding and development of this scientific outlook in the widely differing fields in which he was active: digital computers, the theory of automata, meteorology, game theory, and many other aspects of mathematical modelling.

Von Neumann died suddenly in 1957, aged only 54, as a result of a bone cancer that rapidly laid him low. Several important projects, such as his theory of automata, conceived at the height of his extraordinary scientific career, thus did not get off the ground. And yet, to view his life from a vantage point that is now becoming increasingly remote from the end of the Cold War affords an overview of twentieth century science. This book sets out to illustrate this vast and complex historical panorama without overstepping the inevitable bounds imposed by the need for a measured and non-specialist treatment.[5]

voll., Paris, 1858–69, vol. 24, n. 19390: 398–399). It is instructive to compare this passage with the claim made by François Quesnay, the founder of the physiocratic movement and one of the fathers of the scientific conception of economics: «Let us not seek lessons in the history of nations or human dismay, which portrays to us only an abyss of disorder» (Quesnay 1767).

5) An overview of sources and scholarship regarding von Neumann is provided before the bibliographical references at the end of the book.

No special knowledge is required, though some extremely difficult scientific concepts are discussed. To give a simple and at the same time exhaustive treatment of these issues would have required a book three times as large. In a few places, we opted to avoid trying to explain everything exhaustively. In these cases, we have tried to convey an "impressionistic" idea of these concepts, so that readers can get a general drift of the arguments, and then to guide readers who wish to go deeper into these matters to specialist publications that will help them. It is also possible to skip some of these passages without missing anything very important. Indeed the main aim of the book is not technical but to acquaint as large a reading public as possible with the scientific and cultural significance of one of the greatest figures of twentieth century science and technology.

http://www.springer.com/978-3-7643-9895-8

The World as a Mathematical Game
John von Neumann and Twentieth Century Science
Israel, G.; Millán Gasca, A.
2009, XII, 208 p., Hardcover
ISBN: 978-3-7643-9895-8
A product of Birkhäuser Basel