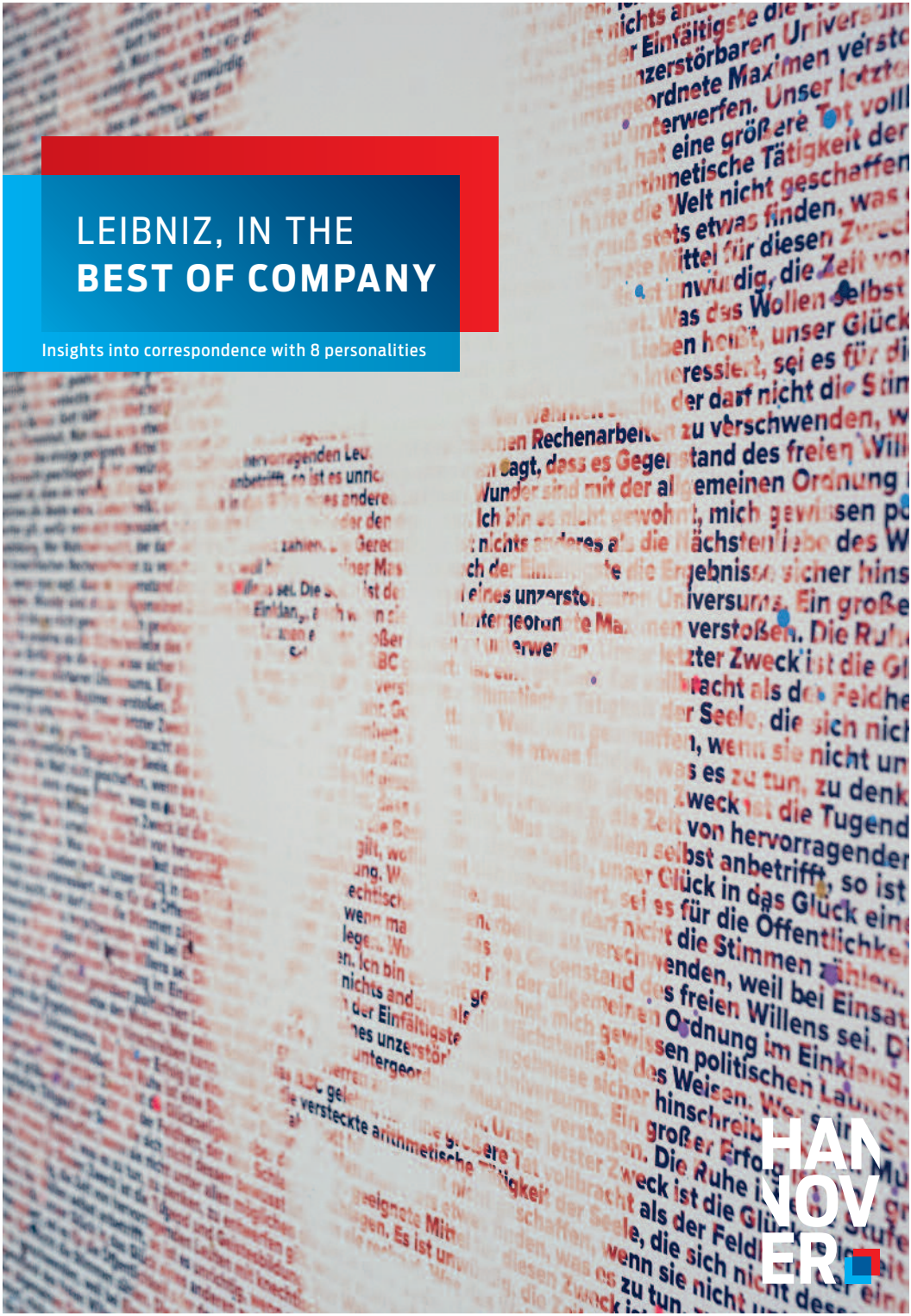
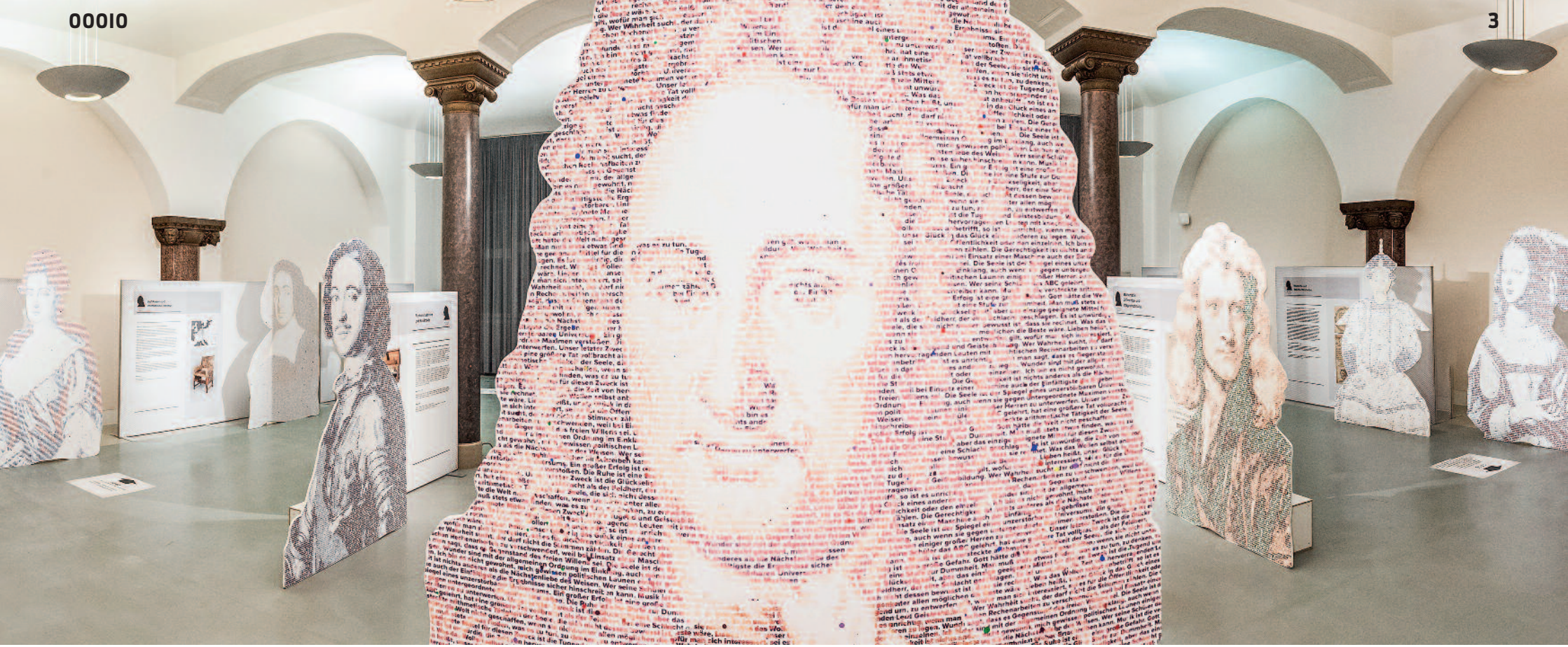


LEIBNIZ, IN THE **BEST OF COMPANY**

Insights into correspondence with 8 personalities



Leibniz, in the best of company

Gottfried Wilhelm Leibniz (1646–1716) was a tireless writer of letters. A fact demonstrated by some 20,000 letters from and to about 1,300 correspondents with whom he was in contact across the globe. The Gottfried Wilhelm Leibniz Bibliothek (GWLB), part of the Niedersächsische Landesbibliothek (Lower Saxony State Library), houses the lion's share of his extensive legacy.

UNESCO accepted the Leibniz correspondence into the Memory of the World Register in August 2007 as a 'unique testimony of the European republic of scholars in its transition from Baroque to the early Enlightenment'.

Interesting insights in the life and work of one of the most prominent scientists and universal scholars of his time can be gained, for example, from the exchange of letters with the following eight eminent contemporaries: Queen Sophia Charlotte, Sir Isaac Newton, Czar Peter I, Baruch de Spinoza, Electress Sophia, Emperor Kangxi, Denis Papin and Princess Caroline.

To see and listen to three letters and a memorandum penned by Leibniz, please visit:
www.wissen.hannover.de/leibniz

Gottfried Wilhelm Leibniz

For Leibniz, Hannover was a blessing and a curse at the same time.

"Every morning he (Leibniz) would travel past my parents' house to the court, because every time his large jet black wig caught my eye (...). His garden, situated in front of the Egydien Gate, full of mulberry trees, I visited once in order to see the silk worms emerge, eat, spin, etc." Thus wrote the later court councillor Schläger on frequently seeing Leibniz during his childhood. The mathematician, philosopher and universalist Gottfried Wilhelm Leibniz spent most of his life in Hannover, although, of his 40 years of service in Hannover, almost half were spent on his travels. He also worked in the residential city of the Dukes of Brunswick-Lüneburg, Calenberg line, from December 1676 as court librarian and court councillor. He subsequently rose to the position of privy and legal councillor, an intermediate post within the court hierarchy. The scientifically bountiful years of 1672 to 1676 in Paris were already behind him.

Leibniz was born on 21 June 1646 (Julian calendar). After completing his studies of law and mathematics, he refused a post as lecturer at the University of Altdorf. A versatile and talented intellect, he pursued proximity to political power throughout his life in order to be able to realise his extensive plans to promote societal advancement. He tirelessly sought access to Europe's many courts, spoke with the Kaiser in Vienna (1688, 1714), met with Peter I, Czar of Russia, three times (1711, 1712, 1716) and hoped in 1716 to move to London to work at the court of George I (Elector Georg Ludwig) as an historian. Despite his fame in Europe as a scientist, philosopher and science organiser he was unable to permanently settle in Vienna, Paris or London. Leibniz died after a short illness on 14 November 1716 in his apartment in the Schmiedestraße in Hannover and was buried on 14 December in the 'Neustädter Hof- und Stadtkirche'.

Leibniz was often described as a scholar who was harassed and under-appreciated by the Hannover Court. Yet, although Leibniz frequently left Hannover, he also returned there time and time again. In truth, Hannover was actually long suffering of this restless scholar who often overreached himself and forgave him when his projects (like the Harz mining project) failed or when he again delayed work on his history of the House of Guelph. Indeed, although frequently vilified by him, Hannover was not only a curse but was also the saviour of this exceptional scientist and polymath.

Gottfried Wilhelm Leibniz. Oil painting, copy after Andreas Scheits, 1703, Gottfried Wilhelm Leibniz Library (GWLB)

Leibniz dies. Copperplate engraving by Wilhelm Arndt, from: Johann August Eberhard, Gottfried Wilhelm Freyherr von Leibnitz, Chemnitz 1795, p. 176; Signature: GWLB: Gd-A 1246

Sophia Charlotte

Leibniz wanted to know everything in the world

His thirst for knowledge was insatiable. As a small boy he devoured every single book in the library of his father, a Professor of Moral Philosophy and notary at the University of Leipzig. He later dreamed of a universal library containing all the knowledge of the world, and was actively involved in establishing major book collections in Hannover and Wolfenbüttel. He was himself a walking library, unifying the knowledge of an entire academy in his own person. He embodied par excellence the Baroque concept of a universal scientist, one with an understanding of all branches of knowledge and all of man's technologies and arts, able to gain new insights in all of these disciplines. Yet, at the same time, his many unfinished plans and failed projects effectively demonstrated the impossibility - as modern sciences advanced and became increasingly differentiated - of all subjects being mastered by any single person alone, no matter how brilliant.

Leibniz was not only concerned with the collection of knowledge but also and above all in its order and systematic organisation. In the course of his combinatory studies, following the publication in 1666 of his 'Dissertatio de arte combinatoria' (on the combinatorial art) he developed a scientific-theoretical process according to which all knowledge - both existing and future - can be derived from the combination of simple concepts. Leibniz was a veritable fountain of ideas, and was repeatedly able to find influential persons in the princely courts and their environs who were willing to support his audacious plans, for example the Prussian Queen Sophia Charlotte (of Brunswick-Lüneburg) who referred to herself as a student of Leibniz and frequently brought him to her court in Berlin. The celestial globe and the terrestrial globe (both originating from Leibniz's period and now at the Gottfried Wilhelm Leibniz Bibliothek) most impressively symbolise the world-encompassing and global interest in knowledge of this exceptional polymath from Hannover.

Terrestrial globe, GWLB

Sophia Charlotte (1668–1705)

From 1684 wife of the Prince-Elector, who in 1688 became Elector Friedrich III of Brandenburg. 1701 Queen in Prussia. Close correspondent of Leibniz. After her death (1. 2. 1705) Leibniz mourned for a long period and lamented his heavy loss in many letters.

Celestial globe, GWLB

Sir Isaac Newton

We still calculate with Leibniz

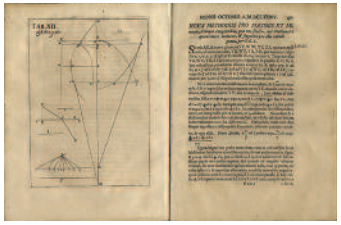
Leibniz claimed many times that he was fundamentally a mathematician. One of the most complex mathematical problems of the age was how to use small rectangles and squares to calculate the area under a curve. Another being that no satisfactory method existed to calculate curves and their gradients (Tangent problem). Leibniz answered both issues with infinitesimal calculus, which combined differential and integral calculations. Using Leibniz's integral calculus it was possible to calculate curvilinear areas and using differential calculus, the tangents of curves. The mathematical discoveries during his Paris period, already completed in October 1675, were only published in 1684 in the article 'Nova methodus pro maximis et minimis' in the Acta Eruditorum.

As early as 1670 Isaac Newton had also developed an infinitesimal calculation, which he referred to as fluxion theory. Newton later accused Leibniz of plagiarism, although Leibniz had in fact developed his calculus without being aware of Newton's method. The conflict between the two mathematical giants of their age came to the fore in 1713 with the publication in London of the 'Commercium epistolicum', an expertise which contained many documents with the intention of demonstrating Newton's priority and exposing Leibniz's plagiarism. The conflict culminated in 1716, the year Leibniz died.

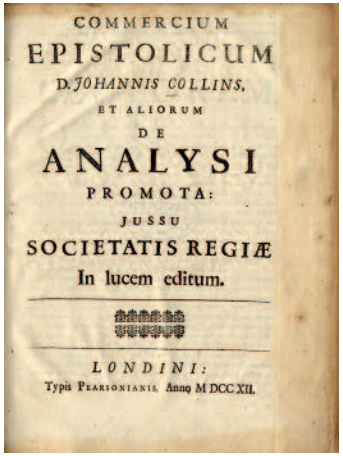
Leibniz's calculus had won over the European continent and went on to establish itself in England in the 19th century. Leibniz's discoveries relating to infinitesimal calculus, which included central aspects of differential equations, differential geometry and series, also set out the foundations of Higher Analysis: basically we still learn the mathematics of Leibniz in schools today.

Sir Isaac Newton (1642–1726)

1669 Professor of Mathematics at Cambridge, 1672 member of the Royal Society, 1699 Master of the Mint, 1703 President of the Royal Society. Newton was involved in a controversial dispute with Leibniz about who first invented calculus.



First publication of differential calculus by Leibniz with depiction of mathematical rules used in calculus. Acta Eruditorum 1684. Signature: GWLB: Aa A35



The 'Commercium epistolicum' of 1713 with Leibniz's hand-written notes. Signature: GWLB: Ms IV 379a

Czar Peter I.

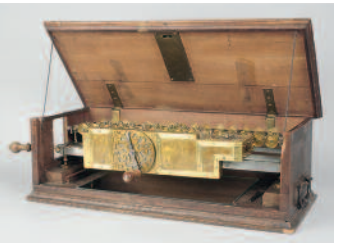
Calculator and binary code are the basis for today's computer technology

Leibniz believed that God created the world based on dimensions, numbers and weight; as a consequence, he considered mathematics to be the key to explaining that which holds the world together at its innermost core. As a mathematician, Leibniz produced two key prerequisites for the emergence of the digital world we know today. He conceived the binary system, comprising zeros and ones, upon which modern digital code is based. He also constructed a complex mechanical calculator to perform automated computing operations. Over many years of painstaking work, several models of a 'calculating bank' were built under his direction. They could perform all four basic arithmetical operations. The 'youngest machine' - now completely dismantled - has survived to the present day and can be viewed at the GWLB.

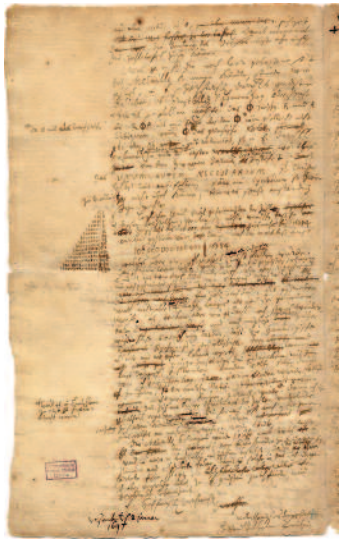
In the summer of 1716, Leibniz met with the Russian Czar in Bad Pyrmont and told him of his calculating machine. He even wanted to send one to Peter I in Russia, but this never came about. Furthermore, Leibniz attempted to design a machine which could calculate using the binary system of ones and zeros. However, this advanced no further than the drawing stage. In principle, such a machine would have been a direct precursor of today's computers. Leibniz's hope was that calculating with zeros and ones would enable complex theoretical mathematical problems to be solved. He also considered the binary system to be symbolic of God's creation. Zero and one symbolise the creation of the world by God out of nothing, he wrote enthusiastically on 12 January 1697 to Duke Rudolf August of Wolfenbüttel.

Peter I. (1672–1725)

Russian Czar since 1682, very interested in introducing European sciences and culture to Russia, travelled Europe, often incognito, from 1697 to 1698. Leibniz met the Czar three times (last time in 1716), previously Peter I (in November 1712) nominated Leibniz as a Russian privy councillor.



Leibniz's four species calculating machine, GWLB



Extract from: Leibniz to Duke Rudolf August (of Wolfenbüttel)
2 (12) January 1697 (the 'New Year's letter'), Signature: GWLB: LBr. F 15, 15 Bl. 19v

Baruch de Spinoza

Leibniz was at home in Europe and had his own social network

Leibniz was by no means a self-conceited thinker who hid himself away behind his desk in his chamber to deliberate. On the contrary, throughout his life he was constantly travelling, endlessly crossing vast swathes of Europe, tirelessly writing letters to members of a wide international network. To develop his thoughts and ideas he did not seek places of silence and tranquillity to concentrate, but rather evolved his wealth of ideas in a permanent state of dialogue with princes, noble ladies and scholars from throughout Europe.

His travels, often over several years, took him to Paris, Vienna and Italy. There were many shorter stays in the Harz mountains, in Wolfenbüttel, in Dresden and Berlin. Leibniz was in The Hague in November of 1676 where he met the famous but controversial philosopher Baruch de Spinoza. The urge to travel and his restlessness did not let up even in the last months of his life. In 1716 he travelled to Zeitz to check the work on his calculating machine, met with the Russian Czar taking the waters in Bad Pyrmont and even made plans for a further trip to Vienna the following year. In order to be able to write when travelling he had a special folding chair built which he always took with him. The Gottfried Wilhelm Leibniz Bibliothek collection includes a folding chair which may well be the very travel-chair or 'post-chair' used by Leibniz.

When not on the move, Leibniz brought the whole world into his study room in Hannover via his global postal network. His correspondence of over 20,000 letters with some 1,300 correspondents has been part of the UNESCO Memory of the World Register since 2007. The high frequency of correspondence continued to the end of his life. Letters addressed to him continued to arrive in Hannover for several weeks after his death on 14 November 1716.

Folding chair ('Leibniz travel chair'), leather, ca. 1700 (?), GWLB

Baruch de Spinoza (1632–1677)

Biblical-Talmudic education within the Jewish community and studies of philosophy, science and mathematics in Amsterdam. Commercial education. 1656 excommunicated by the Jewish community because of religious controversies and ceased business. 1660 worked as lens-grinder in Rhinsburg, 1663 in Voorburg, 1670 in The Hague. 1673 rejected post of Professor of Philosophy in Heidelberg; Leibniz met the controversial philosopher in November 1676 in The Hague and debated Spinoza's theories for the rest of his life.

Sophia of Brunswick-Lüneburg

Leibniz strolled through the Royal Gardens of Herrenhausen and worked on the History of the House of Guelph

In court, Leibniz had a talent in entertaining noble parties and charming them with his intellect. Electress Sophia and her daughter Sophia Charlotte appreciated his presence in the Palace of Herrenhausen and no doubt enjoyed occasional walks together through the lush Baroque gardens. One famous episode in 1692 involves Leibniz challenging Carl August von Alvensleben to find two identical leaves in the Gardens of Herrenhausen, which the aristocratic visitor was apparently unable to do. For Leibniz it was a demonstration of his philosophical principle of individuality, according to which each individual is unique. This episode is famous above all thanks to a copper engraving made by Johann David Schubert in 1795. Sophia and Leibniz had a very close intellectual and platonic relationship. To this day, the picture painted is one of the Electress and the scholar sauntering through the gardens engrossed in never-ending philosophical discussions. This is probably nothing more than a romanticised view from posterity - a projection of Leibniz created by the bourgeois cult of genius during the 19th century.

It is much more likely that Sophia made frequent mocking, ironic comments on Leibniz's metaphysical speculations. She continuously reminded the legal councillor to finally complete his History of the House of Guelph. Indeed, Leibniz had promised his employer, the Elector residing in the Palace of Herrenhausen, to research the Guelph family tree and started work on this major project in January 1680. The history of the Guelph dynasty was one of the main reasons why Leibniz was employed at the court in Hannover. Leibniz worked on the project for decades, and actually focused on it during his last year of life. Despite the immense amount of effort, the History of the Guelphs was unfinished when he died. The massive project was simply on too grand a scale: the story of the House of Guelph touched on not only the history of a kingdom but also encompassed the migration of many peoples as well as the creation of the earth. The work continued after his death but in the form of separate entities. Even today, major parts of this epic work of history have still to be published. Leibniz had simply got out of his depth. However, each part of this history project was of itself a (small) stroke of genius. The 'Protogaea', the History of the Earth, was first published (posthumously) in 1749 and is regarded today as a milestone in the history of geology and palaeontology.

Copper engraving by Johann David Schubert, 1795, GWLB

Sophia of Brunswick-Lüneburg, Electress of Hannover (1630–1714)

Daughter of elector Friedrich V. of the Palatinate, 1658 wife of Duke Ernst August (Elector from 1692), 1701 named as heir to the English throne, was a close confidante and one of Leibniz's patrons. Their correspondence is witness to a close friendship and trusting relationship.

Fossilised molar of a woolly mammoth and the so-called 'Quedlinburg unicorn', copper engraving by Nicolaus Seeländer, Göttingen 1749, Signature: GWLB: Leibn. 211

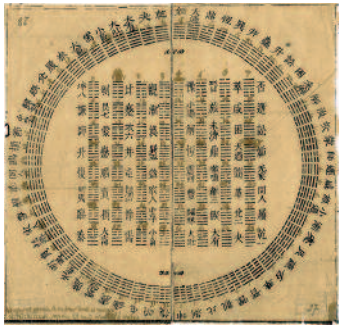
Emperor Kangxi

Leibniz sought the exchange of knowledge and culture between Europe and China

Leibniz lived in a period of historical upheaval. In 1644, two years before he was born, the Manchu came to power in China: the Qing dynasty boosted economic and cultural exchange between the Middle Kingdom and Europe. There were very few scholars on the European continent who boasted such excellent and diverse connections to China as did Leibniz. During his sojourn in Rome in the summer of 1689, Leibniz met Claudio Filippo Grimaldi, a Jesuit priest. This encounter led to a contact with the Chinese missionaries of the Society of Jesus which continued until his death. Leibniz hoped to establish a 'Commercium luminum' between Europe and China, an exchange of experience between the two civilisations in all areas of science, technology and culture. The first fruit of these efforts was the publication of his 'Novissima Sinica' (1697), intended to disseminate the latest news from the Far East in Europe and to foster a greater level of interest amongst Europeans for China.

Leibniz was fascinated by the achievements of this ancient civilisation located at the edge of the Eurasian continent. When Joachim Bouvet, a Chinese missionary and Jesuit Priest reported from Beijing in November 1701 that he had discovered that the 64 hexagrams of ancient Chinese 'Yi Jing' represented the binary system of zeros and ones, Leibniz was most enthusiastic. Leibniz also had a China plan of his own with several objectives. He strove to achieve not only cultural transfer but also to open up China for the Protestant mission and to develop economic ties.

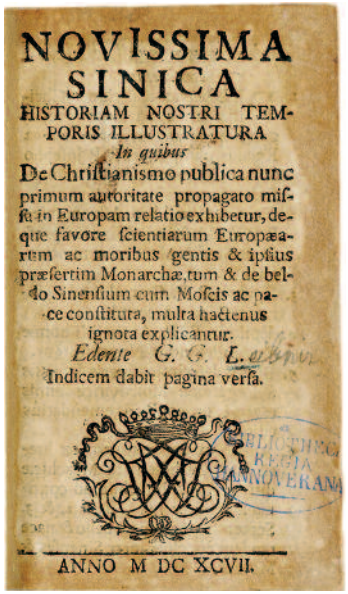
While Leibniz is today portrayed as an ambassador for current cultural-political ideals, it should not be overlooked that Leibniz was in no sense proposing an unrestricted exchange of cultures amongst equals. He repeatedly chastised the Jesuit missionaries that they were too generous in their distribution of European products, technologies and knowledge without ensuring there was adequate compensation from the Chinese. Leibniz feared that Europe's equal ranking with China could turn into one of inferiority. Leibniz considered China and Europe to be in competition with one another and frequently described their relationship in words which remind us less of open cultural interaction and rather of competing civilisations.



Page of the Ming encyclopaedia 'Sancai tuhui' (1609 and more often), enclosure in a letter from Joachim Bouvet to Leibniz, Beijing, 4.11.1701, Signature: GWLB: LK-MOW Bouvet10 Bl. 27-28

Kangxi, Chinese Emperor (1654–1722)

Kangxi is known for his interest in art and sciences. He gathered many Jesuit missionaries to his court in order to gain an understanding of European cultural achievements. Leibniz contacts were indirect, mediated by Joachim Bouvet, a Jesuit priest who was in Beijing to teach the Emperor mathematics and astronomy.



Title page 'Novissima Sinica', 1697, Signature: GWLB: Leibn. 200

Denis Papin

Leibniz sought a link between theory and practice in science and technology

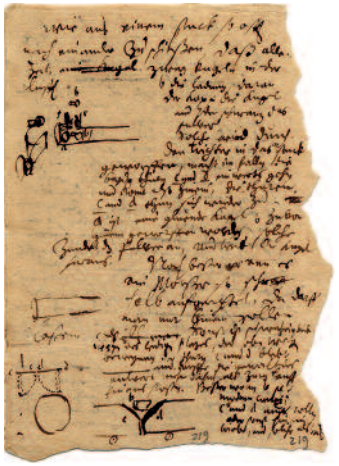
The advancement of the empirical sciences and the beginnings of the industrial revolution engendered an atmosphere of euphoria for progress and enthusiasm for technology in Europe of the 17th century which culminated in Leibniz's vision for achieving the best of all possible worlds by way of the technical implementation of rational planning. As an inventor, technician and forerunner of modern-day 'engineers', Leibniz designed not only calculating machines but also presented technical proposals for mining in the Harz mountains (horizontal winch, speed regulator, conveying spindle and chain), he was involved in hydraulic engineering (canal building, pumps and water lifts) in Herrenhausen and also developed plans for fire insurance as well as medical concepts for health care.

His widespread postal contacts supplied Leibniz with information on developments in the fields of technology and science, such as the discovery of phosphorous, the production of distillates from sugar solutions as well as the development of giant magnifying glasses. He disputed with inventor Denis Papin about the definition of forces in dynamics and, though his correspondence, learned about Papin's experiments in 1691 and 1692 with a submarine in the river Fulda and the court of the Landgrave of Hessen-Kassel. He followed the reports in 1716 with great interest about an alleged 'perpetuum mobile'. As a science organiser, Leibniz was involved in the establishment of academies to promote technology and science. Leibniz considered it normal that scientific and technical knowledge and inventions should also be applied to military purposes. He contemplated the building of fortifications, provisions for army units as well as enhancements to munitions and armaments. His efforts in the field of weapons technology peaked with his attempts to invent and construct his own rapid fire rifle. Many of his plans and designs were unsuccessful, many experiments failed. However, such failures should not be seen as negatives: on the contrary, in science failure is a precondition for progress.

Leibniz's drawing of his 'horizontal wind engine'. Signature: GWLB: LH XXXVIII, Bl. 313r

Denis Papin (1647–1712[?])

From 1675 collaboration with Robert Boyle and the Royal Society London. 1687 Professor of Mathematics in Marburg, 1695 advisor to Landgrave Karl von Hessen-Kassel, 1707 return to London. Inventor and experimenter (including steam engines). Intensive correspondence with Leibniz, including disputes on the definition of forces in physical dynamics.



Sheet with notes and pen drawing of a projectile apparatus by Leibniz, Signature: GWLB: LH XXXVI, Bl. 219r

Caroline of Ansbach

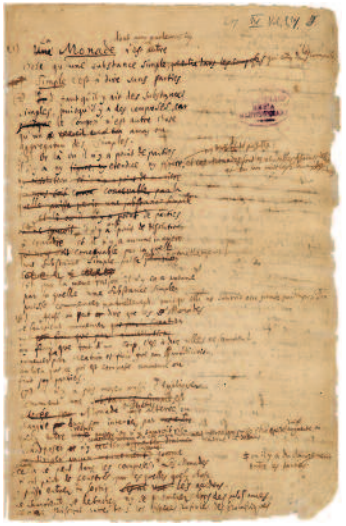
There is nothing dead in the entire universe, or everything is linked with everything else

Leibniz was not only a specialist in almost all fields of knowledge of the time but also intended to investigate the basis of all things. Everything in the world, according to the basic statement of Leibniz's metaphysical philosophy, can be deduced from simple, indivisible units or substances, which Leibniz, referred to as spiritual monads in contrast to plain material atoms. Leibniz considered monads to be indestructible and that consequently there was nothing dead in the world but rather everything was in a permanent cycle of creation and decay. Each simple monad is like a little mirror of the universe from its own perspective, such that in his representation everything was linked with everything else.

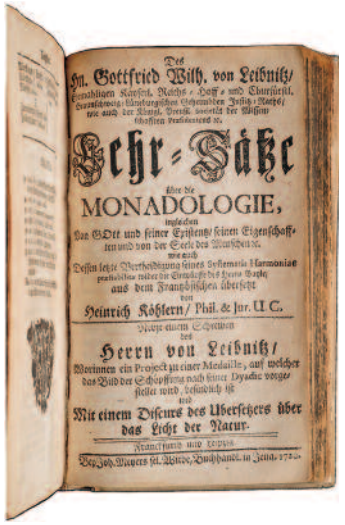
Leibniz's metaphysics of monadology still has its puzzles today. It can be understood against the backdrop of Leibniz spending his entire life attempting to develop a philosophy unifying theology and science, rationality and Christian belief. As a protagonist of Philosophical Optimism, he believed God had created the best of all possible worlds. In his 'Theodizee' of 1710 he explained the evil of this world as necessary and useful for the good of the whole. Leibniz's closest debating partners at the Court of Herrenhausen included Caroline of Ansbach, the later Princess of Wales. When in England she attempted to mediate between the philosophies of Newton and Leibniz. Her postal initiative resulted in the famous correspondence between Leibniz and Samuel Clarke in November 1715, who defended Newton's position. In contrast to Newton and his disciples, Leibniz was of the opinion that space and time were not absolute but in some way relational, a concept which returned later in Einstein's Theory of Relativity.

Wilhelmina Charlotte Caroline of Brandenburg-Ansbach, Princess of Wales (1683–1737)

Following the death of her mother 1696, grew up under the guardianship of Elector Friedrich III and Sophia Charlotte of Brandenburg(-Prussia). On 2.9.1705 married Elector Georg August of Hannover, 1714 Prince of Wales, 1727 George II of Great Britain and Ireland. One of Leibniz's close debating partners together with Sophia and Sophia Charlotte. Caroline attempted to mediate between the philosophies of Newton and Leibniz and played a key role in the renowned Clarke-Leibniz correspondence of 1715 and 1716.



Leibniz's manuscript on the later 'Monadologie', 1714, Signature: GWLB: LH IV, 1, 1a Bl. 1r



German translation of 'Monadologie', 1720, Signature: GWLB: Leibn. 9147

Gottfried Wilhelm. oil (copy). La Bonté after an unknown artist, 1788, GWLB

Leibniz's apartment in the Schmiedestraße, coloured steel engraving by E. Willmann after G. Osterwald. Darmstadt (approx. 1860), Leibniz-Archiv

This brochure was prepared after the exhibition 'Leibniz in bester Gesellschaft' at the Neues Rathaus in Hannover to mark Leibniz Year 2016, celebrating Gottfried Wilhelm Leibniz on the 300th Anniversary of the death of the mathematician, philosopher, inventor and polymath. The exhibition was a co-production of the Gottfried Wilhelm Leibniz Bibliothek, the Leibniz-Archiv, Landeshauptstadt Hannover (Wissenschaftsstadt department), Hannover Marketing und Tourismus GmbH as well as artist Tobias Schreiber.

Our grateful thanks goes to all those who contributed to the success of this project.

Concept/text: Prof. Dr. Michael Kempe with the collaboration of employees at the Leibniz-Archiv, Hannover

Text copyright: Prof. Dr. Michael Kempe, Leibniz-Archiv/Leibniz Forschungsstelle Hannover

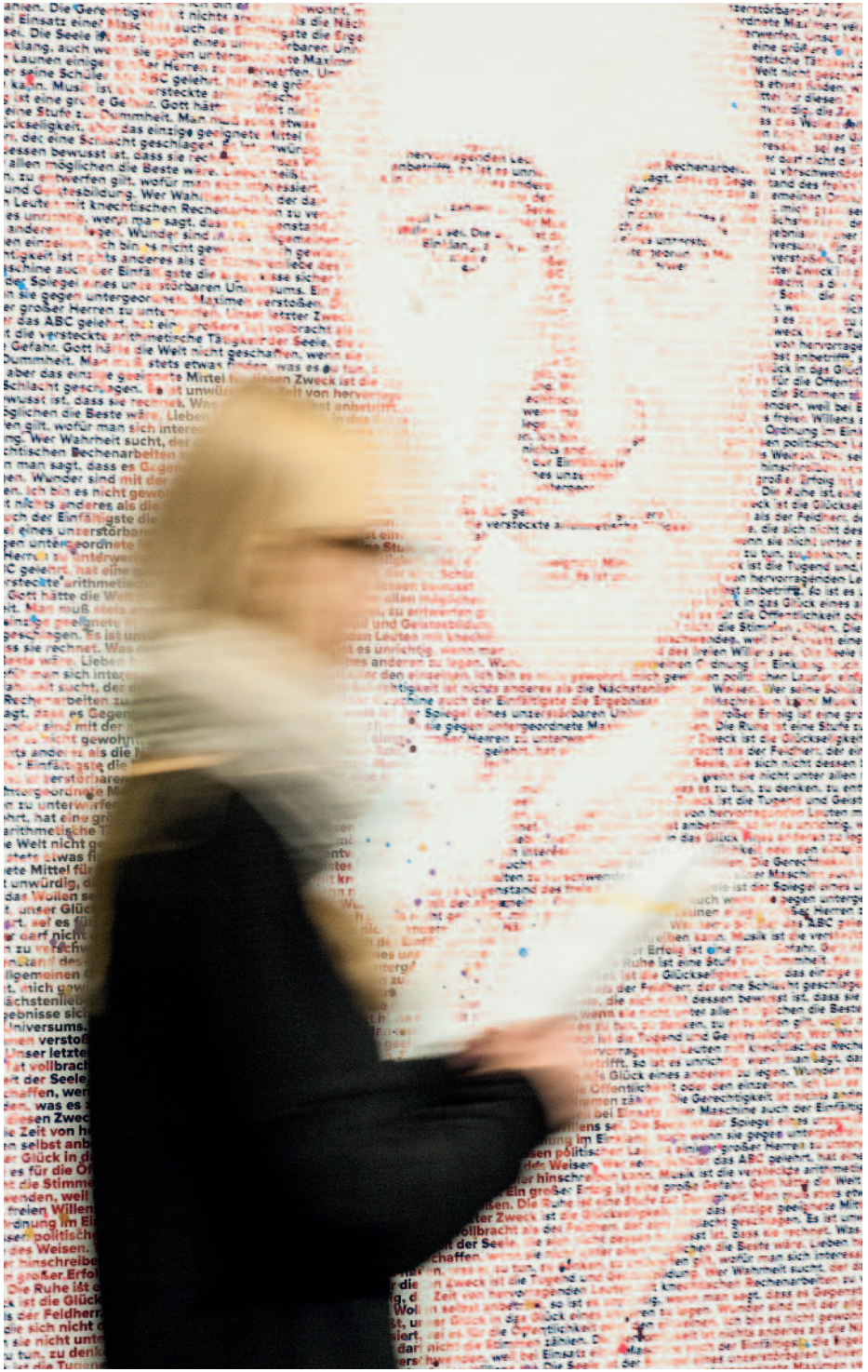
Object photos: Jutta Wollenberg, GWLB

Typo portraits: Tobias Schreiber

Concept consulting / design / production / technology: werbeladen gmbh, Hannover-Langenhagen

Project management / editorial: Theda Minthe and Dr. Silka Rodestock, Landeshauptstadt Hannover, Büro Oberbürgermeister - Wissenschaftsstadt Hannover
E-Mail: info@initiative-wissenschaft-hannover.de

GOTTFRIED WILHELM LEIBNIZ BIBLIOTHEK
NIEDERSÄCHSISCHE LANDESBIBLIOTHEK



Landeshauptstadt Hannover

LANDESHAUPTSTADT HANNOVER
Büro Oberbürgermeister
Wissenschaftsstadt Hannover

Trammplatz 2
30159 Hannover

E-Mail: leibniz@hannover-stadt.de
info@initiative-wissenschaft-hannover.de

Photography:
LHH/Patricia Kühfuss

Design:
Formfürsorge/Jörg Wesner, Hannover

Translator:
Dietrich Buglass

As of: January 2017

Listen to and see Leibniz (audio texts and videos)
www.wissen.hannover.de/leibniz

All dates and more information:
www.hannover.de/leibniz