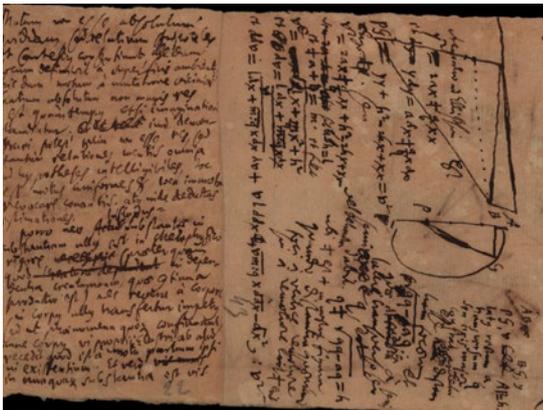


Focus

UNDERSTANDING LEIBNIZ'S THOUGHTS

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Reconstructed fragments.

The great polymath Gottfried Wilhelm Leibniz noted his thoughts and ideas on countless pieces of scrap paper – an immeasurable wealth of knowledge as paperwork in the most literal sense. Using digital reconstruction, the Leibniz Puzzle project is set out to shed some light on his ideas.

By Katrin Pudenz

On a piece of scrap paper, the great scholar wrote about himself: “When I wake up in the morning, I have so many ideas in my head that the day is not long enough to write them all down.” Professor Michel Kempe, Head of the Leibniz Editorial Center in Hanover, says that he couldn't have put it more aptly himself. Gottfried Wilhelm Leibniz noted his thoughts on everything, including philosophy,

metaphysical observations and physical ideas, religion, language and mathematics. Sometimes, notes on various topics were found on the same piece of paper in different languages. Leibniz worked in German, and most frequently in French and Latin. “He noted philosophical ideas mostly in Latin or French and mathematical ideas in Latin,” explains Dr. Siegmund Probst, Deputy Head of Department at the Leibniz Editorial Center. The fact that paper was exorbitantly expensive was a major concern for Leibniz. “That is why Leibniz used every square inch of a piece of paper.”

Organized filing in boxes

However, Leibniz also tried to order his chaos by cutting up the numerous pieces of paper and storing them in a small box system according to topic. “Leibniz wrote out his thoughts and then went back to organize them afterwards,” is how Kempe summarizes Leibniz's working method.

Born in Leipzig, he was a prolific thinker. The Leibniz-Archiv has collected a great trove of fragments, bits and pieces of Gottfried Wilhelm Leibniz's comprehensive legacy, which consists of some 200,000 pages and is kept in the Leibniz-Bibliothek in Hanover. It goes without saying that to sort this wealth of knowledge into chronological order is a tedious and almost insurmountable task. However, the reconstruction of the many small snippets has been the goal of the Academy Edition and the Leibniz-Bibliothek for many years now. By piecing the fragments back together, it will be possible to understand the chronological context and retrace how Leibniz's ideas, with all their ramifications, came to be.

Assistance from scanning and analysis systems

Until now, the sheer amount of fragments made it impossible to piece them back together manually. Only when researchers managed to put together two fragments manually by chance were they able to gain a deeper insight into the way of thinking of the universal genius. Now, they are using a computer-based scanning and analysis system to accomplish this task. As part of the Leibniz Puzzle project, the text fragments are to be sorted and, more importantly, put together. Researchers from the Leibniz Editorial Center (Goettingen Academy of Sciences and Berlin-Brandenburg Academy of Sciences), the Gottfried Wilhelm Leibniz-Bibliothek (Bibliothek = German for library), the Fraunhofer IPK Institute for Production Systems and Design Technology and the MusterFabrik Berlin are working together on this project. And they were already able to reconstruct a part of the fragments. The researchers make use of the same technology that previously helped restore shredded Stasi documents. They designed a high-performance scanner for the project in the Leibniz-Bibliothek and further developed the algorithms of the software that was used to

reconstruct shredded Stasi documents. Now, the software can also detect and classify the precise and fine cut edges of the Leibniz fragments.

High-performance scanner digitalizes LH35

In a pilot project, 7,200 sheets from the LH35 department of the Leibniz estate were scanned with pixel-free resolution. The front and back pages of the originals were not only re-created in digital form but also X-rayed, in order to reproduce all shapes, colors and watermarks without any distortions. The scanned fragments are classified and analyzed using a digital image processing program that can detect cuts and tears, corners and lines, paper colorations and structure. If possible, the pieces are then put back together. The reconstructed notes are then submitted to librarians and editors.

The idea to put the Leibniz fragments back together was inspired by the work on the Stasi files. “Mr. Probst read a newspaper article back in 2011 about how the shredded Stasi files were put back together using a digital assistance system from Fraunhofer IPK,” remembers Kempe. Probst adds: “That’s how I realized that we could do the same with the Leibniz fragments.” In 2015, work began on the pilot project. The project is funded by the Klaus Tschira Foundation.

Casting light on Leibniz’s ideas

The goal of the research project is to cast light on Leibniz’s ideas and to precisely date his notes for the first time ever. Furthermore, the researchers want to digitalize the complete Leibniz collection and make it available for use and research across the globe. “By 2019, every single snippet of the Leibniz collection should be fully digitalized,” says Probst. The results and findings of the project will be included in the historical-critical edition “Gottfried Wilhelm Leibniz, Complete Writings and Letters”, which has been a work in progress since the beginning of the 20th century.

“During our work on the mathematical group LH35, in which we processed 2,400 fragments out of 7,200 sheets, we found 67 new results during our digitalization and reconstruction efforts,” reports Kempe. “And in turn, this means that we were able to produce 67 new text contexts too.” Probst adds: “As a result of this, we realized that a series of documents that had already been dated had to be chronologically reordered.” What is more, the reconstructed documents presented entirely new contexts. “For example, we discovered that Leibniz made notes on the metaphysics of movement, on Newton’s theory of gravity, as well as on thoughts on the movement of the planets all next to each other on the same piece of paper,” explains Kempe. Through the reconstruction, it became clear how intertwined the topics were for Leibniz, as well as how he thought and worked.

Leibniz is putting his thoughts in order himself

“And Leibniz himself did the groundwork for our Leibniz Puzzle project,” explains Professor Kempe. “After all, he created the theoretical foundation of modern computer technology with the binary system. In principle, we are simply using his technology on him. It all comes full circle.” ■

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