

The academics who helped breathe new life into Notre-Dame

Five years after a devastating fire, the Paris cathedral has finally reopened, with the help of a vast team of researchers

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[Emily Dixon \(/author/emily-dixon\)](#)

When acoustics researcher Brian Katz reflects on the day Notre-Dame cathedral burned, what he remembers most is the quiet. “I live about a 20-minute walk away, so I witnessed it first hand,” he said. “It was the first time I’d ever been surrounded by hundreds and hundreds of people all standing in complete silence.”

Within days of the 15 April 2019 fire, Dr Katz, research director of the CNRS

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Jean Le Rond d’Alembert Institute at Sorbonne University

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receiving calls for help. Four years earlier, his team had taken acoustic measurements of the

Paris church, creating a “digital acoustic twin” of the space that would prove crucial to the

restoration process. Dr Katz went on to join a major scientific project centred around the

restoration, launched by the CNRS (<https://www.timeshighereducation.com/world-university-rankings/cnrs>), France’s national research organisation, and the Ministry of Culture.

When Notre-Dame reopened on 7 December, it was thanks, in part, to the efforts of 175 researchers with expertise across a range of disciplines: acoustics, art, data, history, archaeology, anthropology. “The restoration has been based on academic work,” said Christophe d’Alessandro, also a CNRS (<https://www.timeshighereducation.com/world-university-rankings/cnrs>) research director at Sorbonne and an organist who specialises in musical acoustics, organology, music history and speech processing. “When it came to the question of how to restore this aspect or that, all the knowledge came from academics.”



Source: UDOVIC MARIN/AFP/Getty Images

To aid the cathedral's restoration – and glean new scientific understanding from the process – nine working groups were set up: acoustic, wood and framework, monumental decorations, emotions and mobilisations, metal, digital data, stone and mortar, structure and glass. The metal group analysed the materials and methods used in the cathedral's construction, while the glass group looked at its ornate stained-glass windows and the surface deposits that accumulated during the fire. The emotions and mobilisations group saw social scientists study the "diversity of meanings" the public attached to Notre-Dame, and "the way in which the fire profoundly changed the meaning of the cathedral itself".

"From analysing materials to modelling structural behaviour and documenting emotional responses to the fire, researchers have provided the knowledge base that underpins the restoration," said architect Livio De Luca, another CNRS (<https://www.timeshighereducation.com/world-university-rankings/cnrs>) research director. The work of these scientists, he said, "extends beyond Notre-Dame, offering methodologies and tools that can benefit the broader heritage field."

As his train pulled out of Paris on 15 April, Dr De Luca learned about the fire engulfing Notre-Dame via a text from his wife. "It was a profound shock," he said. Then his training kicked in. "As an architect and a researcher, I immediately began thinking about the consequences for the structure, and the potential role that our expertise in digital documentation could play in understanding the damage and supporting the restoration."

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Dr De Luca coordinated the working group on digital data, using photographs, 3D scans and reports to create a "digital twin" of Notre-Dame. The model "enables researchers and restorers to analyse the monument's past, present and future states", he told *Times Higher Education*. His working group digitally reconstructed the cathedral's timber frames, nave and transept, while facilitating "the identification and relocation of hundreds of architectural fragments" as well as "the integration of scientific data into a shared platform that continues to evolve as a resource for research and education".

At the time of the fire, Dr d'Alessandro was playing the organ at the Sainte Élisabeth church, two kilometres away. Appropriately, his work at Notre-Dame centred on its two historic organs: the great organ, which underwent intensive cleaning to remove accumulated lead monoxide, and the choir organ, which suffered greater damage and required reconstruction.

He will continue his music history research after the cathedral doors reopen, hoping "to better understand when large organs appeared in Gothic cathedrals". His team will "make new measurements to compare the acoustics before and after the restoration", he said.

Dr Katz will also continue to work on the acoustics of Notre-Dame, with considerations including how best to minimise noise from tourists while optimising the sound of the choir and organs. “What we’ve been doing with this project aside from the research aspect has been trying to figure out new ways of communicating the research results, because of the importance of Notre-Dame to the rest of the world,” he says. Earlier this year, his team produced an audio guide to the cathedral, titled *Notre-Dame Whispers*, while they are currently working on a film, *Vaulted Harmonies*, to demonstrate the evolution of music and acoustics within the space.

Dr d’Alessandro last saw the Notre-Dame interior in June. “I saw the cathedral as I’d never seen it before – cleaned, the paintings restored, the space entirely empty,” he said. He was due to attend the official reopening; afterwards, he expected to be a regular visitor. “I work not far from Notre-Dame, just on the opposite bank of the Seine,” he told *THE*. “I think I’ll take every opportunity to pass a short moment there.”

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