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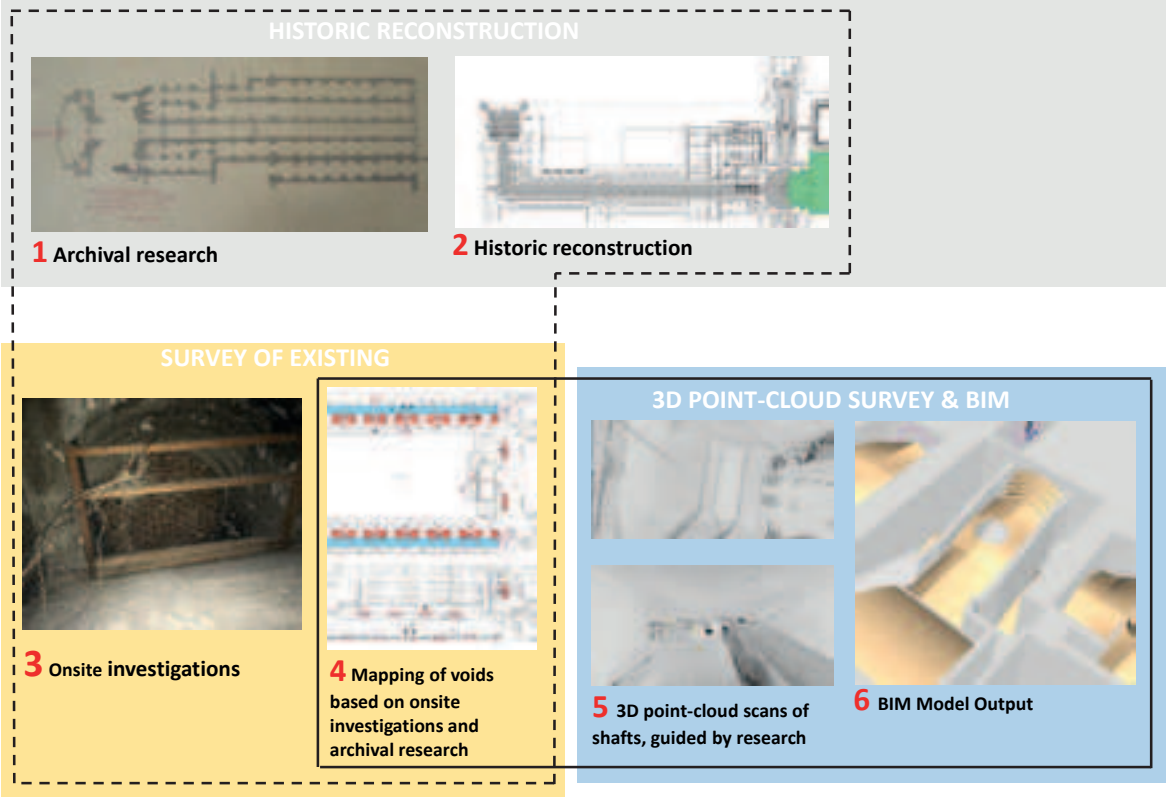
Historic research as an applied science

A collaborative project at the Palace of Westminster shows how academic research can provide a better understanding of environmental technology in historic buildings.



The process by which research underpinned production of the BIM model

The relationship between university-based research and architectural practice has been subject of longstanding debates. Among recent contributions to this debate is the RIBA report *How Architects Use Research*[1]. It explores how academic scholarship undertaken within the universities can contribute towards the advancement of the architectural profession, and how it complements practice-based research undertaken by architectural firms.

In *Adding Value to Architectural Practice: demystifying architectural research*, another RIBA study, Ann Dye and Flora Samuel introduce architects to academic research methods and their applications in practice.[2] In both of these studies academic research is primarily understood as an activity serving the needs of industry, while the specific requirements of its academic institutions received only marginal considerations. In 'What is "architectural design research"?' Alan Short, who is both a practitioner and academic, argues that architectural research suffers from a schism between architecture as a profession and a field of academic research.[3]

This article aims to argue that academic projects involving collaborations with industry can only succeed if they are based on a mutual understanding of the nature, and specific requirements of architectural practice and research. The first is to maintain the integrity of the research as academic scholarship, publishable in peer-reviewed journals or books, the other to ensure it can support the work undertaken by practitioners.

The article explores the challenges of embedding academic research within live conservation projects, using the author's current research project 'Between heritage and sustainability: restoring the Palace of Westminster's 19th-century ventilation system' as a case study. This project, funded by the Arts and Humanities Research Council, is embedded in the Palace of Westminster restoration and renewal programme, a client body appointed by Parliament to coordinate the refurbishment. By being embedded the research was able to directly feed into the work of the client and external design consultants.

The project has two primary objectives. The first is to gain a critical understanding of the history, design and technical performance of the 19th-century system. The second is to explore

ways in which the historic principles could be reused and integrated into a modern system, harnessing its potential in providing a more sustainable approach to ventilation. In the refurbishment of highly-serviced public buildings from the 19th and 20th centuries, the reuse of historic infrastructure could offer a new approach to reconciling tensions between conservation and sustainability. The palace contains a sophisticated stack-ventilation and warm-air central heating system[4] that provided the precedent for many public buildings in Europe and North America.[5]

Between scholarship and applied science

A prerequisite to implementing this new approach is an in-depth knowledge of the environmental principles underlying the design of historic buildings. Archival research, complemented by site investigations and technical analysis, was used in this project to reconstruct the design of the historic system, how it was operated and how it performed. It retraced the alterations made throughout its operational life to improve its performance or accommodate new technologies. The process of reconstructing the historic design and its performance has been illustrated in articles published in *Architectural History*, *AA Files* and the *Journal of the Society of Antiquaries*.[6]

In this project the use of academic research has two primary functions. The first was to expand our understanding of the history of environmental design in architecture, and the second to create new technical knowledge of historic buildings, informing the work of architects and engineers in architectural conservation.

While previous publications by architectural historians have highlighted the significance of the palace within the wider history of building services engineering, they have offered little insight into its technical design or performance.[7] The research undertaken in the context of this project is distinct from more conventional approaches to architectural history by integrating technical perspectives and methods of analysis into the interpretation of archival material.

The article published in the *Journal of the Society of Antiquaries*, for instance, includes an analysis of its historic performance based on historic measurements, scientific and technical reports, eyewitness accounts and the log-books kept by the attendants operating the system. This yielded insights into the behaviour of historic technologies on which future design studies, to be undertaken in collaboration with the engineers and architects, can draw. It also offered insights into the historic design concepts and objectives and how these differed from modern approaches to natural stack ventilation.[8] Although both follow similar principles, there are fundamental differences in their technical implementation. If the aim is to build on the historic principles ,they need to be critically reappraised in the light of 21st-century technology, standards and regulations. It is a 'critical restoration'[9], and to gain the required understanding it is fundamental that technical and historical perspectives be fully integrated.

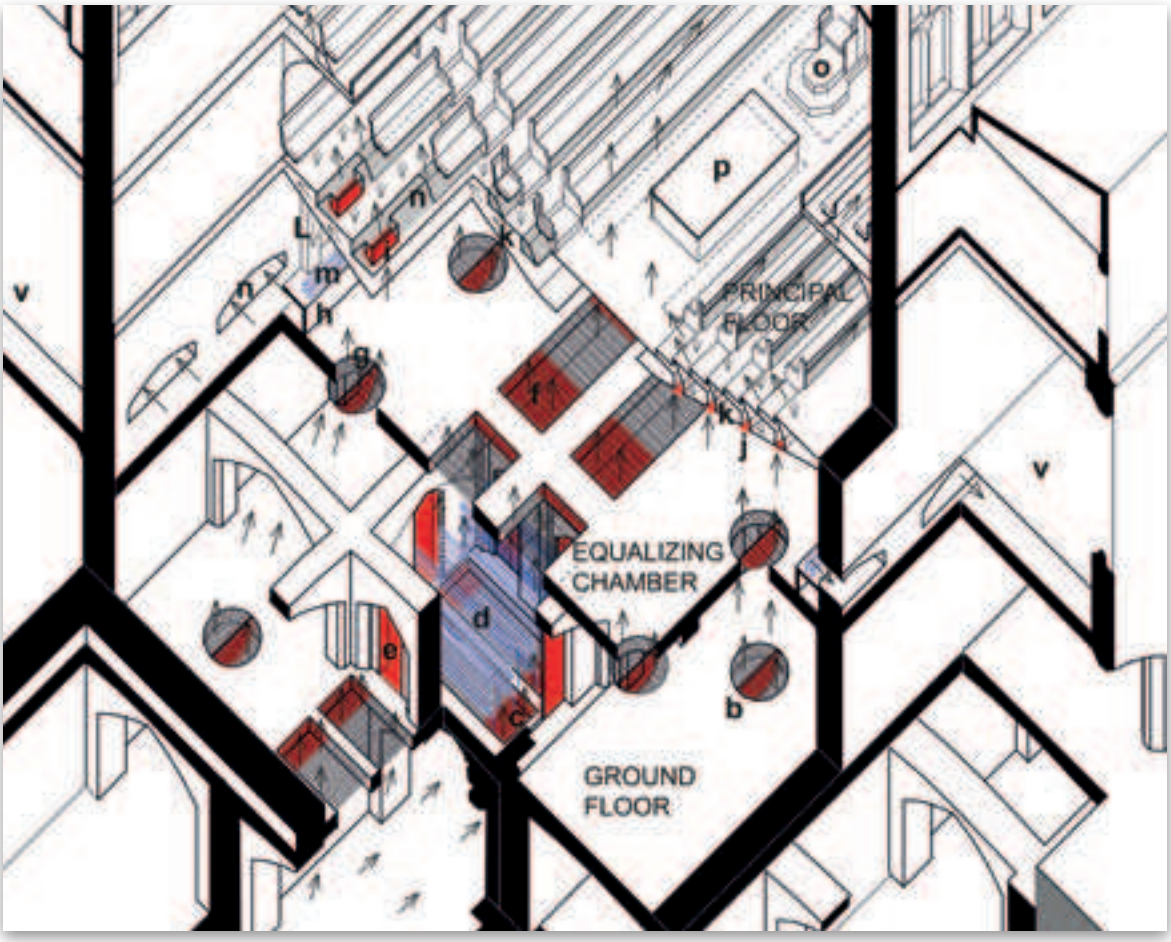
Bridging the gap

Although the academic research discussed above has yielded knowledge relevant to conservation practice, it is not sufficient to facilitate its effective use in practice. A process is still required to enable its application. In this project this issue was addressed by distinguishing between three distinct, yet closely interlinked, workstreams. The first stream, which is the academic research leading to scholarly publications, is followed by two intermediate stages. The first of these is concerned with the process of translating academic research into useable design knowledge. In this project it involved shifting the focus from historical research towards technical surveys of the existing physical infrastructure, for which the scope of site investigations and archival research had to be extended considerably.

The findings were disseminated among the consultants and within the client body through a series of detailed reports and a programme of knowledge exchange activities, which comprised lectures, Q&A sessions, workshops and site visits. The reports produced in conjunction with the first intermediate stage were distinct from academic publications, and were based on additional research that the author had to undertake in parallel to his academic work. The second intermediate stage, which required close collaboration with the consultants and managers of the client body, focused on facilitating the process of research utilisation.

The transition from the translation to use is best illustrated by the research undertaken to underpin the 3D-point cloud survey of the palace. It began with producing a detailed reconstruction of the historic system in its original state. This was largely based on studies of original archive material, such as drawings, letters or contract specifications.

A set of drawings was produced to show both the surviving and the lost features of the system. The latter included vulnerable features such as valves, scientific instruments and pulleys used to regulate and monitor the system or the heating, cooling and humidification arrangements. The lost features are fundamental to fully understanding the historic infrastructure and how it operated. At the next stage these drawings were verified through site reconnaissance. Its purpose was, first, to check the drawings against the



Part of an axonometric projection of the first system deployed in the House of Commons chamber, 1852–54

physical evidence inside the palace, second, to gain insights into aspects not covered by historic drawings and, third, to map the extent that the historic system is preserved or lost.

To record the findings of these investigations the author produced a photographic survey and a second set of drawings, which provided the foundational knowledge required to plan a systematic 3D-point cloud survey of the historic ventilation. The information was used to instruct the surveyors from Plowman Craven to undertake scans. A small-scale pilot, focusing on selected voids inside the House of Lords, was undertaken in 2016.

The final output of this process was a virtual three-dimensional representation of the historic infrastructure that was fully incorporated into the BIM model of the palace. The author is currently working with Plowman Craven and the architects BDP on the development of a standard methodology by which information on the historic system can be effectively integrated into the BIM model. The model will provide the foundation for forthcoming design studies investigating the possibility of reusing the historic infrastructure.

This process shows that it is fundamental to clearly define the boundaries between research and practice-facing activities. Activities facilitating the integration of academic research into practice became a substantial part of the project. They are time-intensive, often competing with time allocated for academic research, and managing these tensions represents the main challenge for academic research project embedded within practice.

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Henrik Schoenefeldt, senior lecturer in sustainable architecture at the University of Kent and AHRC leadership fellow, is seconded to the Houses of Parliament to lead a research project 'Between Heritage and Sustainability: restoring the Palace of Westminster's nineteenth-century ventilation system'.