**Title: Re-appraising and rebuilding the environment in the House of Commons, 1913-1950**

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**Abstract:**

*The House of Commons, destroyed during air raids in 1941, was rebuilt between 1944 and 1950, incorporating a sophisticated air conditioning system. This was portrayed as a radical departure from the nineteenth-century technology of its Victorian predecessor, but new research has revealed that its design was building on the findings of earlier investigations into improving the historic system, addressing questions thermal comfort and user experience. Its design followed concepts that were originally introduced by the physiologist Leonard Hill in 1914 and a series of design studies and experimental trials were undertaken in the 1920s and 1930s to develop a detailed scheme. This article explores the process by which occupants, scientists and engineers collaborated to empirically evaluate and improve the historic system, focusing on the period from 1913 until 1937, and how this had informed the design of the new system for the post-war debating chamber, which was developed between 1943 and 1950, also became subject of post-occupancy evaluation two years after its completion. This offers critical insights into practices in environmental design in the first half of the twentieth century.*

**Introduction:**

The current debating chamber of the House of Commons in London was built between 1944 and 1950 and it replaced an earlier, 19th-century chamber, that had been destroyed during air raids in 1941. The reconstruction was designed by the architects Giles and Adrian Gilbert Scott but he also collaborated with the engineer Oscar Faber in the design of a modern mechanical ventilation and air-conditioning system. Adrian wrote that it was ‘*new method of electrical air conditioning,* originating from the US and that it *‘was the first occasion of its use on a large scale in this country*’[[1]](#endnote-1). Faber described it as a ‘radical solution’ that exploited advances in technology and scientific research, yet new archival research has revealed that it directly build on insights that had been gained in the past through studies inside the historic chamber. The latter had acted as a site for environmental investigations for 89 years, engaging with questions of air quality and thermal comfort.Most of these studies were undertaken in response to criticism from Members of Parliament (MPs) about environmental conditions, and as the main users they also initiated and led several technical inquiries. Its first environmental control system had been developed by the physician David Boswell Reid between 1847 and 1852.[[2]](#endnote-2) (FIGURE 1)This incorporated facilities for humidification, heating, cooling and air filtration that had been tested and refined inside Temporary Houses of Commons, a provisional chamber created after a fire in 1834 had destroyed the original medieval chamber.[[3]](#endnote-3) Failing to meet MPs expectations, however, Reid’s systems became the subject of two inquiries, conduced by Select Committees in 1852 and 1854, and was substantially altered.[[4]](#endnote-4) Dissatisfaction with the thermal conditions did not cease and over the following 87 years it underwent multiple investigations, concerned with evaluating and improving its design, and utilising tools and analytical methods that reflected the scientific advances made over this period. These investigations culminated in a series of studies in the early 20th-century, which involved post-occupancy evaluations, hypothetical design studies and technological trials. These were the last inquiry into the historic system and they yielded plans to fundamentally remodel the historic system, building on new physiological research and utilising modern mechanical ventilation and air conditioning. This scheme was based on the believe that the defects of the existing system could n>aot be overcome through an evolutionary process, in which existing arrangements are improved through small incremental changes without questioning the fundamental concepts behind its design.

The 19th-century investigations cannot be discussed here but are examined in detail across three papers, published in *Building Research & Information*,[[5]](#endnote-5) *Architectural History*[[6]](#endnote-6) and the *Antiquaries Journal* respectively.[[7]](#endnote-7) This article focuses on the final investigations into the historic system, covering the period from 1913 to 1938, and explores how they affected the development of a system during the 1940s. Its premise is that these investigations are critical to understand the origins of the concepts, theories and design methodologies used in the development of Faber’s scheme. They also offer insights into practices of building science in the first half of they 20th-century, addressing not only technological and operational but also human factors. These practices were reconstructed based on original archival material, such as scientific reports, drawings, letters and parliamentary papers, which are held at the Palace of Westminster, National Archive and at Historic England.

1. **Radical proposals for the old chamber, 1913-38:**

The first series of scientific studies, undertaken at the time ASHVE (1894) and ASRE (1904) were established, had focused largely on questions of air purity and concerns about the transmission of airborne pathogens, but beginning in 1913 the focus shifted towards questions of thermal comfort, responding to new research into the physiological effects of indoor climates undertaken by the physiologist Dr Leonard Hill at the Medical Research Council (MRC). Hill was a pioneer of thermal comfort research, which, as Gail Cooper has shown in her book *Air-conditioning America,* strongly influenced the development of thermal comfort research in the US during the 1920s. This included important studies conducted in the laboratories of the ASHVE and Harvard School of Public Health.[[8]](#endnote-8) In Westminster his research profoundly influence the direction of inquiries over for the following 35 years. His research was first brought to the attention of the First Commissioner of Works by Sir John Rees, MP for Nottingham East, who, personally dissatisfied with the climate conditions, saw it as evidence that MPs should be concerned about their health.[[9]](#endnote-9) In 1913 the House of Commons appointed a Select Committee to lead an inquiry into this issue, which subsequently engaged Hill as a consultant to re-evaluate the historic system in the light of his physiological theories. Hill undertook several measurements and collaborated with Robert Barker, a building services engineer from UCL, in developing detailed proposals for remodelling the system.

The diagnosis of Hill’s study was that the physiological effect of internal currents rather than air quality was the main problem. He reported that the system ‘*caused a draught which had a cooling effect on the feet and legs of the members whereas there was not sufficient movement of air round their heads and shoulders*’[[10]](#endnote-10) He argued that this issue could be resolved by discarding the use of floor outlets and replace them with a new outlets at a higher level that were integrated into the face of the galleries. [[11]](#endnote-11) Located above the head, he believed that they would enable fresh air to be injected horizontally into the space without exposing MPs to direct currents. In addition he recommended maintaining a different type of indoor climate. Arguing that the sense of drowsiness reported by MPs was caused by the breathing of warmed air, he advised a reduction in the atmospheric temperature and the provision of warmth through radiant heaters between the benches. He also considered the climate as too uniform and advised introducing more physiologically stimulating conditions through gentle variations in temperature and air movement. The latter was to be achieved by alternating the direction of the currents.

In its final report, published in 1914, the Committee recommended the adoption of Hill’s scheme, but advised it to be verified experimentally. Due to the outbreak of the First World War these investigations were intermitted for several years. The resumed in the 1920s, when the Office of Works and Public Buildings, a government department responsible for the maintenance of the parliamentary estate, established a collaboration with National Physical Laboratory (NPL) to conduct studies focusing on the internal air movement. These began in 1921 with air flow simulations with large physical models at a scale of 1:8. (FIGURE 2) These models, which were erected at the NPL’s laboratory in Teddington fulfilled similar functions to CFD simulations in contemporary practice. They gave engineers the freedom to test and refine hypothetical proposals, including more expensive and radical interventions, before they were tested at full-scale or permanently applied inside the chamber. The models were used to study the behaviour of internal air currents, comparing the existing arrangements with the proposal to move the oulets to the gallery level. (FIGURE 3) The air currents were traced visually using fine powder and their strength was measured using hotwire anenometers. The final scheme was tested with a full-scale mock-up inside the actual chamber in 1923.

This was composed of temporary ducts and nozzles, which were made from cardboard and fitted along the front of the galleries, and during the trials the chamber was filled with smoke to trace the air movement. (FIGURE 4)

Having focused on air currents these studies had only examined one feature of Hill’s scheme. Other important aspects, such as the use of radiant heating, had not been investigated. In the 1930s, however, the Office of Works commissioned further studies in response renewed criticism, this time in both Houses of Parliament. first time legislators were requesting an inquiry into the use air conditioning as a means to improving thermal comfort. It was first proposed by Lords in 1931 and MPs discussed the idea in 1935. As the House of Lords had similar technical arrangements, a joint study was undertaken, which included full-scale trials of radiant heating systems in combination of lower air temperatures (FIGURE 5), and a feasibility study on the use of air conditioning. For these studies the Ministry collaborated with Dr Thomas Bedford, another eminent physiologist from the MRC, who, similar to Hill, was undertaking research into thermal comfort. He was leading a study for the Industrial Health Research Board, investigating the impact of indoor climates on the comfort, health and productivity of factory workers, which was published in a report entitled ‘*Warmth factor in comfort at work*’ in 1936.[[12]](#endnote-12) His work in Westminster involved longterm monitoring of temperature and humidity, which lasted from October 1936 to September 1937 and several in-depth studies of the internal air movement. In addition he developed a programme of user-surveys and interviews to evaluate the indoor climate from user-experience perspective[[13]](#endnote-13) The final outcome of these investigations were ambitious plans to abandon and replace the 19th century system, which were first outlined in a White Paper from 16 July 1936.[[14]](#endnote-14) This shows that the Office of Works was proposing to combine Hill’s scheme for changing the architecture of the air supply with the introduction mechanical ventilation and air conditioning. Whilst these plans already contained the key features of Faber’s later scheme, political circumstances prevented it from ever being realised within the historic chamber. It was initially postponed due to financial constraints imposed by the UK rearmament programme and the subsequent outbreak Second World War. Its destruction in May 1941 brought the inquiries into the historic system to an abrupt end. Its destruction forced MPs to initially decant to Church House, later to the chamber of the House of Lords for sittings, yet as soon June 1941 MPs began discussing the rebuilding of the lost chamber and the concerns underlying the pre-war investigations continued to influence the discourse.

1. **Rebuilding the House**

**– the continuation of a longstanding inquiry, 1943-50.**

It has to be noted that MPs themselves were leading the initial investigations into the rebuilding between 1941 and 1945, in which Prime Minister Winston took a central role. These began with ideas and expectations being voiced and discussed during debates or parliamentary questions and the final design for the new chamber was developed under the direction of a Select Committee. This was composed of MPs, who collaborated with the Ministry of Works and a team of external consultants. The fact that the procurement of the design was overseen by MPs, not engineers or architects, is significant, as it resulted in their first-hand experience of the historic conditions strongly influencing idea about its future design. Churchill voiced his views for the first time during parliamentary questions on 19 June 1941. He advocated a close reconstruction of the historic interior, rejecting suggestions from other MPs for changes to its layout, form or dimensions or proposals for relocation to a new site outside the Palace of Westminster. He argued that changes should be limited to *’some improvement in the system of ventilation, or some minor re-adjustment of the accommodation in the galleries not affecting the size, shape or character*.’[[15]](#endnote-15) On 5 February 1942, when questioned by Percy Hurd, MP for Devizes, if he intended to retain ‘*that traditional character of the ventilation of the old chamber*,’ Churchill reiterated that he ‘*especially* *excepted that traditional feature*’ from those to be closely reconstructed.[[16]](#endnote-16) A first tentative set of plans for the rebuilding was produced by the Ministry of Works in autumn of 1943, which envisaged to simply reinstate the original chamber with some improvements. Churchill again noted that it included ‘*certain desirable improvements and modernisations affecting the ventilation*’. Despite Churchill’s assurances regarding the use modern building services, a deep felt discontent with the historic arrangements continued to be voiced during several sittings.[[17]](#endnote-17) This illustrates that memories of the problems with the historic system had not faded and continued to shape MPs’ views of the requirements for a modern chamber. On 4 November 1843, for instance, Sir William Davison wished that the new chamber ‘*should not be ventilated by air driven through Honorable Members’ feet*.’[[18]](#endnote-18) On 28 October 1943 Churchill presented a motion for the appointment of Select Committee to coordinate the development of ‘*plans for the rebuilding of the House of Commons and upon such alterations as may be considered desirable while preserving all its essential features.*’[[19]](#endnote-19) This was followed by an impassioned debate, in which the need to overcome the defects of the historic ventilation was raised by several MPs. It was first mentioned in the speech of Arthur Duckworth, MP for Shrewsbury. He argued that the House ‘*suffered from a system ventilation which is antiquated and calculated to give everyone cold feet and a hot head*’. George Buchanan, MP for Glasgow Gorbals, noted that it had a ‘terrible atmosphere,’ and Captain Cunningham-Reid, sitting for Marylebone, said that ‘*felt with other Members that it is absolutely essential*’ that the ‘*ventilation should be considerably improved*.’ Somerset de Chair, who sat for South West Norfolk, argued that there was insufficient ventilation and light that ‘*made a lot of Members very unpleasant and uncomfortable*’ and also claimed that he had ‘*seen admirals come into the House red in the face from the quarterdeck and within a week they were as white as lily from the lack of ventilation*’. Arthur Greenwood, MP for Wakefield, ask for improvements to ventilation, which he has ‘*always heard defended, though I never met any Member of the House who though it was any good*.’ John Wilmot, MP for Kennington, rejecting the historic ventilation as outdated technology conceived before the age of electricity, made a plea for an air-conditioned chamber.

At the end of this debate MPs voted 127 to 3 in favor of Churchill’s motion. The Committee began sitting in December 1943, and it conducted interviews with senior office holders in House of Commons to revisit the MPs experience of the historic conditions. These held similar views to those expressed in the earlier debates. Douglas Brown, Speaker of the House of Commons, for instance, described the system as ‘*archaic*’ and the Gilbert Campion, Clerk at the House of Commons, argued that MPs ‘*had suffered under the old system*’ and that it should be improved. Sir James Edmondson, Assistant Serjeant-at-Arms, argued that there was ‘*much cause of complaint*’ about the ventilation and supported idea of introducing modern air-conditioning.[[20]](#endnote-20)

In January 1944 the Committee reviewed Ministry’ earlier scheme. The original drawings show that this proposal envisaged a close reconstruction that re-utilised much of the surviving architectural fabric,[[21]](#endnote-21) but A. G. Ramsay, a mechanical engineer and Assistant Director of the Ministry of Work, had produced plans for the building services that closely followed Hill and Barker’s proposal from 1914. Ramsay believed that it would be sufficient to eliminate the historic problems.[[22]](#endnote-22) Following the advice of Eric de Norman, Deputy Secretary of the Ministry of Works, the committee appointed external consultants to develop the plans. Choosing from a shortlist of consultants supplied by the RIBA and IMechE and IEE, the Committee appointed Giles and Adrian Gilbert Scott as architects the consulting engineers Oscar Faber for the structural engineering and building services. Working closely with the architects, Faber and his assistant Robert Kell developed a detailed scheme. This incorporated modern mechanical ventilation and air conditioning technology, but it also closely adhered to Hill’s original plans. Dr R.E. Stradling, Director of building research at the Department for Scientific and Industrial Research (DSIR), noted that it followed the ‘*physiological disiderata enumiated by Dr Leonard Hill in 1914*’[[23]](#endnote-23). In July 1944 Faber submitted a detailed written statement and 15 drawings to the Select Committee, outlining his proposal and the underlying design objectives.[[24]](#endnote-24) In his statement Faber wrote that his scheme intends to ‘*conform to the best practice of air conditioning*’ and eliminate the ‘defects’ of the historic system that MPs had alluded to in their speeches.[[25]](#endnote-25) Faber had studied the historic issues by reviewing parliamentary records on previous investigations, including reports relating to the studies by Hill, Bedford and the NPL.  In a lecture given at the Institution of Structural Engineers in February 1949, Faber noted that the historic approach to the supply of air led to continual complaints about ‘*hot heads and cold feet*,’ an issue, which despite large number of investigations, was never resolved.[[26]](#endnote-26) He said that ‘*arguments might have continued indefinitely had not Hitler provided the opportunity for a radical solution*’[[27]](#endnote-27) The original drawings, held Parliamentary Archives in Westminster,[[28]](#endnote-28) show that Faber had abandoned the historic practice of introducing fresh air through perforated floors, and replaced it with a system of high-level outlets, which he believed would allow to provide adequate ventilation without exposing MPs to drafts. One set of outlets, situated below the gallery, was introduced to inject fresh air horizontally at mid-level. The second set, located along the edge of the ceiling, was introduced to supply conditioning air to the top half of the chamber. He also proposed alternating the supply from side to side, arguing that it would be ‘*conducive to alertness*’ and prevent ‘*any portion of the anatomy being subjected to a constant air current in any direction*.’

Faber admitted that his concepts needed to be verified and refined experimentally, and he advised engaging the MRC and NPL to conduct the studies under his supervision. In an earlier letter to the Ministry, dated 29 June 1944, Faber had provided a sketch and detailed specifications for these experiments.[[29]](#endnote-29) (FIGURE 6) He proposed erecting a life-size section of the bottom half of the chamber, noting that it was only necessary to study the effect of the lower outlets below the gallery, which, due to their relative proximity to the benches on the principal floor, were more likely to cause discomfort than the higher outlets inside the ceiling. He wrote that the purpose of the tests was to simulate the behavior of the currents and determine how they affected MPs seated on the main floor, taking into account a range of velocities (from 300 to 600 feet per minute) and temperatures (0 to 15F below the internal temperature).

Responding to advise by Stradling,[[30]](#endnote-30) however, the Ministry of Works insisted that the tests were designed and delivered by scientists.[[31]](#endnote-31) In a letter sent to Eric de Norman, Secretary of the Ministry of Works, on 31 July 1944, he had warned that the engineers should not be in charge of designing their own experiments, and instead advised assigning this responsibility to a panel of scientists from the DSIR, ensuring the empirical tests are both scientifically reliable and under an authority independent from the engineers. He wrote that they ‘*should be asked to advise on the best type of experiment and not requested to carry out detailed measurements laid down by an amateur on research*’[[32]](#endnote-32) In a note to the Secretary of the MRC, dated 14 August 1944, de Norman wrote that

‘the direct responsibility’ should be with the engineers and should not be undermined by the Ministry, but at the same time has the ‘*duty to parliament in seeing that they have before them a scheme which promises to be as effective and suitable as experience and modern science can devise’*.[[33]](#endnote-33)

This critique is significant as it acknowledges that the project could only be delivered through a wider collaboration with other disciplines. It acknowledges building science and building services engineering as separate disciplines, offering different, yet complementary skills, perspectives and body of knowledge. A team of physicists from the NPL, which collaborated closely with engineers at the Ministry of Works, was charged with planning and delivering the experiments, and Bedford from MRC was re-engaged to evaluate the scheme from a physiological perspective, focusing on thermal comfort as a design criteria. The design of the tests was subsequently reviewed by a panel composed of staff from the Ministry of Work and the scientists from the MRC and NPL, which had two meetings with the architects and engineers in August 1944.[[34]](#endnote-34) At the second meeting the NPL proposed significant changes, arguing that two set of experiments would be necessary to provide reliable data. The first tests constituted air flow simulations with large physical models, built at a scale of 1:4, which were to be proceeded by trials with a life-size model of a section of the chamber. On 23 August 1944 Bedford submitted his appraisal of Faber’s scheme from a physiological perspective.[[35]](#endnote-35) Whilst satisfied with the proposed experiments as a way of determining the intensity of current near Members heads, he provided guidance regarding the minimum and maximum velocities. He highlighted that at an air temperature of 65F velocities higher than 40 feet per minute would produce uncomfortable draughts, but under 20 feet per minute ‘are likely to be accompanied by feelings of stuffiness’. If the the temperature reach 70 to 72F velocity should be increased to at least 45 feet per to improve comfort.

The experiments fulfilled the same function as computational fluid dynamics and thermal simulations in contemporary practice, but in the 1940s undertaking such simulations involved complex physical experiments that were expensive, time consuming and also relied on specialist skills and equipment. De Norman saw these studies as a way of reducing the ‘risk of failure’ (3 August 1944) but in autumn of 1944 the Ministry of Works became concerned about costs. According to an initial estimate, produced by Ramsay on 12 September 1944, the experiments would only cost £3500 and last one year, but a more detailed estimate, submitted on 27 September 1944, revealed that they would be much higher with a revised total cost of  £14,000, with £10,000 alone for the full-scale studies. This covered the construction, technical equipment as well as the service of the scientific researchers. Fearing that the project could be delayed if parliament rejected to sanction a budget for these studies, De Norman suggested omitting the life-size replica and limit the investigations to experiments with scale models.[[36]](#endnote-36) Ramsay, however rejected his suggestion as unwise. In a letter to de Norman from 6 November 1944 he warned that if tests were not done at the design stage they could face the risk of expensive alterations at a later stage if ‚Dr Faber‘s guess is not right.‘ He stressed that the research cost only equate to 1.5% of the total project budget, which he believed in ‘*building of this importance and publicity seems a small assurance*‘. In December de Norman retracted his earlier criticism, writing that the expense for ‘research is not unreasonable’ for a project of this scale.[[37]](#endnote-37)

The Select Committee published its final report on 25 October 1944, in which it made a strong case for 'thoroughly up-to-date system of heating, ventilation and lighting', dismissing the historic technology as 'thoroughly antiquated’.[[38]](#endnote-38) Parliament approved the Committee’s recommendations on 25 January 1945, and on the following day the Office of Work finally authorised the models to be constructed. Air flow and thermal simulations, involving the use the scale models, were undertaken at NPL in June 1945,[[39]](#endnote-39) and between July and December 1945 the NPL tested the results of the simulations at full-scale inside a life-size model, which was erected at Exhibition Hall at Earl’s Court. It constituted a 30-feet section of the whole chamber had a width of 52 feet and a height of 46 feet. It’s primary purpose was to verify the reliability of the scale model simulation and test the detail design for the outlet nozzles.[[40]](#endnote-40) (FIGURE 7)

Although following a similar approach to their experiments in 1920s, the NPL had to produce a much larger and technical complex model, capable of simulating both air movement and atmospheric temperatures. It was used to simulate the thermal conditions within the seating areas, and how this was affected by the direction, speed and temperature of the air entering through the nozzles at both levels. It was equipped with miniature ductwork, electric fans and air nozzles for the supply and extraction of air, including fresh air nozzles in the ceiling and below the galleries. (FIGURE 8) The models included furniture, such as the Speaker’s chair, table and the benches, and electric light bulbs, covered with aluminium cones, were installed on top of the benches to simulate the heat input from MPs’ bodies. During the tests the scientists used smoke for tracing the general air flow pattern, and scientific instruments, including hot-wire anemometers and electric thermocouples, to take accurate measurements of the temperature and velocity of the air currents in 20 different positions.

The primary objective of the tests was to scientifically evaluate and refine Faber’s proposal from a thermal perspective, focusing on internal air movement as a key factor. In letter from June 1948 Faber stressed that it was physiological, rather then technological criteria that were sitting ‘limits to air speeds’ and the test were used to prove that air blown in ‘horizontally above the heads could not be felt’.[[41]](#endnote-41) These were to guarantee that the new arrangement would not expose MPs to currents at speeds in excess of 100 feet per minute, which is the rate at which air movement becomes noticeable. The design was refined following an iterative approach, in which schemes were tested and gradually adjusted. The investigations took into account the affect of architectural aspects, such as position, number and dimension of air outlets, as well as operational aspects, such as system settings and alternative control regimes. The first tests revealed that the original configuration of ceiling outlets produced currents in excess of 100 feet at head level and in subsequent tests they were gradually enlarged, by extending them from originally two to all four sides of the chamber. This allowed same volume of fresh air to be introduced at lower speeds. At gallery level the intensity of the currents was reduced by adjusting the original flow rate settings, which was not permitted to exceed 6000 cubic feet per minute. One of the findings was that it was advisable to supply air simultaneously from both side, but that the direction of the supply should be alternating between the two sides.[[42]](#endnote-42), and that the supply air had to be 57F to maintain a temperature of 62F to 64F at floor level.[[43]](#endnote-43)

These inquiries into the operational aspects formed part of Faber’s wider plans to achieve a dynamic and responsive system, taking into account changes in internal user activity and external weather conditions. In the historic chamber the responsiveness of system relied on staff observing manually control and monitoring procedures. In the new chamber Faber introduced a semi-automated monitoring and control network, which was equipped with an array of electric sensors, permitting the temperature and velocity of the incoming and outgoing air to be continually monitored,[[44]](#endnote-44) and the control engineers also surveilled changes in attendance with the aid of a periscope.[[45]](#endnote-45)

In 1950, shortly before the House of Commons was formally reopened, the operational regimes were further tested and refined inside the actual chamber through a series of trial sittings**.** To recreate the conditions of crowded chamber, contingents of several hundred guards were engaged to take the place of MPs. A further performance evaluation, led by Bedford, was also undertaken four years after its completion. These involved the analysis of recorded climate data, air flow tests as well as the review of personal feedback received from MPs about their experience of new climate, which were used to make adjustments to the operational settings.

1. **Conclusion:**

This paper has shown that design of the post-war debating chamber was the outcome of a longstanding inquiry into issue of thermal comfort that had begun inside the historic chamber and lasted over 30 years. In retrospect the House of Commons could be interpreted as a field for scientific and technical research, bringing together scientists, engineers and occupants to engage with specific challenges associated with environmental control in legislative chambers. Faber’s reconstruction harnessed recent technological advances and new scientific research, but it also allowed Hill’s original ideas to be implemented retrospectively, unimpeded by the physical constraints of the historic fabric or the financial barrier that had compromised earlier investigations. Faber’s system represents an evolution of an earlier scheme. The conceptual leap towards a radical solution breaking with the historic principles had already been made 30 years earlier.

The investigations undertaken before and after destruction of the historic chamber were linked by inquiries into the design of systems based on physiological criteria. Their primary concern were not the mechanical engineering aspects of building services, but the indoor climate conditions and their affect on occupants. And as a direct results of this physiological focus the engineers became reliant on wider cross-disciplinary collaborations with research scientists. These provided the specialist knowledge, equipment and working methods required to asses and further develop their schemes.

The investigations were also the manifestation of an experimental tradition in the field of environmental design. Empirical evaluations were at the core of the design methodologies followed before and after the war. They were deployed to study the actual performance of existing arrangements, a practice that today would referred to as post-occupancy evaluation, and also to provided designers with reliable data on the effectiveness of proposals at the design stage. In the latter physical experimentation fulfilled the same role as computational simulations tools in contemporary engineering practice. These experiments are also evidence of an awareness of the potential gap between predicted and actual performance of buildings, which in this case was driven by the knowledge that the new chamber, similar to its 19th century predecessor, would be judged by its ability to satisfy the expectations of its critical users.

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19. “House of Commons rebuilding,” Hansard, HC Deb 28 October 1943 vol 393 cc403-73 403 [↑](#endnote-ref-19)
20. Report from the Select Committee on House of Commons (rebuilding) together with photographs, plans and sections, and the proceedings of the committee, House of Commons, 109, 1944. [↑](#endnote-ref-20)
21. The original drawings of this scheme are held at the Historic England Archive in Swindon. Chest 38 ‘House of Commons (fragile) Plan at the principal floor, Scheme C.1, November 1942, Ministry of Works and Planning; Plan at the first floor, Scheme C.2, November 1942, Ministry of Works and Planning; Longitudinal section looking west, Scheme C.4, November 1942, Ministry of Works and Planning; Cross-section looking north, Scheme C.5, November 1942, Ministry of Works and Planning. [↑](#endnote-ref-21)
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31. Letter from Eric de Norman to Stradling and Batch, 3 August 1944 (National Archives, Work 11/418) [↑](#endnote-ref-31)
32. Letter from R. E. Stradling to Eric de Norman, 31 July 1944 (National Archives, Work 11/418) [↑](#endnote-ref-32)
33. Letter from R. E. Stradling to Sir Edward Mellanby, 14 August 1944 (National Archives, FD1/1211) [↑](#endnote-ref-33)
34. Minute of Meeting held on 22 August 1944 (National Archives, Work 11/418); W. R. L. Trickett, Minutes of Meeting, 9 August 1944 (National Archives, Work 11/418) [↑](#endnote-ref-34)
35. Letter from T. Bedford to R. E. Strandling, 23 August 1944 (National Archives, FD 1/1211) [↑](#endnote-ref-35)
36. Letter from Eric de Norman to Tricket, 19 October 1944 (National Archives, Work 11/418) [↑](#endnote-ref-36)
37. Letter from Eric de Norman to Batch, 4 December 1944 (National Archives, Work 11/418) [↑](#endnote-ref-37)
38. Report from the Select Committee on House of Commons rebuilding, 25 October 1944 (HC 109 1944) [↑](#endnote-ref-38)
39. ,Earl’s Court - Full Scale Model, 26 June 1945, (National Archives, Work 11/418) [↑](#endnote-ref-39)
40. Faber O. and Kell J., The heating and air-conditioning of the House of Commons, *Journal of the Institution of Heating and Ventilating Engineers*, December 1951, p. 14 [↑](#endnote-ref-40)
41. Letter from O. Faber to Ministry of Works, June 1948 (National Archives, Work 11/418) [↑](#endnote-ref-41)
42. Letter from Faber to Dr Hankins (NPL), 15 December 1945, National Archives, Work 11/418) [↑](#endnote-ref-42)
43. Faber, Report, December 1945, National Archives, Work 11/418) [↑](#endnote-ref-43)
44. Ministry of Works, “House of Commons Air Conditioning Installation. Explanatory Note on the design and operation of the automatic control system, Section A, May 1855. (Strategic Estates Archives, Palace of Westminster) [↑](#endnote-ref-44)
45. The rebuilding of the House of Commons The Builder, 7 September 1945: 185–186. [↑](#endnote-ref-45)