



DEAN HAWKES

# ARCHITECTURE AND CLIMATE

AN ENVIRONMENTAL HISTORY OF BRITISH ARCHITECTURE 1600–2000

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*An Environmental History of British  
Architecture, 1600–2000*



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# Architecture and Climate

Tracing the evolving relationship between the architecture and climate of Britain from the late sixteenth to the twentieth century, Dean Hawkes presents an original approach to the study of architecture and climate. Through detailed studies of buildings by major architects, the book deftly explores how the unique character of the climate of the British Isles has had a fundamental influence on the nature of buildings of all kinds and periods, in both country and city.

Based on extensive documentary research and on first-hand analyses of significant buildings, the book combines architectural history with the parallel fields of climate history and the representation of environment in literature and the fine arts. It spans the period in British architectural history from the late sixteenth to the twentieth century; from the buildings of the greatest architect of the Elizabethan age, Robert Smythson, to the work of his twentieth century near namesakes, Alison and Peter Smithson.

Beautifully illustrated with drawings and photographs, including a colour plate section, the book brings a historical dimension to the appreciation of the environment in architecture and, equally, introduces an environmental element to the study of the history of architecture.

**Dean Hawkes** is emeritus professor of architectural design at the Welsh School of Architecture, Cardiff University and emeritus fellow of Darwin College, University of Cambridge. His previous books include *The Environmental Tradition* (1996), *The Selective Environment* (2002) and *The Environmental Imagination* (2008). In 2010 he received the RIBA's biennial Annie Spink Award for excellence in architectural education.

*For William and Mary*

# Architecture and Climate

It is a common belief that the climate of a country determines the architecture of that country. This is a very old idea, and it is one that has been repeated many times. In fact, the climate of a country does not determine its architecture. The architecture of a country is determined by many factors, including the climate, the culture, the history, and the economy of that country.

For example, the architecture of a country may be determined by its culture. In many countries, the architecture is a reflection of the culture of that country. In some countries, the architecture is a reflection of the history of that country. In other countries, the architecture is a reflection of the economy of that country.

Therefore, the climate of a country does not determine its architecture. The architecture of a country is determined by many factors, including the climate, the culture, the history, and the economy of that country.

It is a common belief that the climate of a country determines the architecture of that country. This is a very old idea, and it is one that has been repeated many times. In fact, the climate of a country does not determine its architecture. The architecture of a country is determined by many factors, including the climate, the culture, the history, and the economy of that country.

# Preface

In the literature of architecture the importance of the relationship between climate and building is widely accepted, particularly in the discourse of so-called architectural science. The concern is to define instrumental relationships between the physical characteristics of climate and the nature of buildings. These explain how to design buildings that will keep their occupants warm in cold places and cool in hot places and that respond to the diversity of the seasons. This is all of immense practical value and has been given further impetus with the emergence, in the last couple of decades, of the concern to make buildings more 'environmentally friendly', indeed to be overtly 'climate-responsive'. The present book aims to expand the scope of the debate by bringing a historical perspective to bear upon the way in which buildings both respond to and, in some respects, give expression to the climate in which they are set.

The study is concerned with architecture in Britain in the four centuries from 1600 to 2000. It carries us, in a sequence of thematic essays, from the remarkable 'prodigy' houses of Elizabethan England to the work of significant architects who explored these questions in the latter years of the twentieth century. At the beginning of this period the condition of climate was a matter not just of subjective experience, but of rich description in the media of literature and art. In the seventeenth century the tools of meteorological observation were developed, as part of the emergence of experimental natural philosophy, and soon began to influence the relationship of climate to architecture. One of the important developments in the eighteenth century was the systematic collection of weather data, which became a common pastime of country landowners and parsons. At the same time, the environmental characteristics of buildings began to be codified, with the publication of formulations and tabulations of guidelines for elements such as the dimensions of window openings and fireplaces. Then the fruits of the Industrial Revolution, in the form of developments of devices for the improved warming and ventilation of buildings, enabled the builders of the nineteenth century to define a new set of relationships between architecture and climate, in particular with the disagreeable, polluted microclimate of the expanding cities. In contrast to this 'industrialization' of the architectural environment,

the close of the nineteenth century saw the emergence of the Arts and Crafts phase of British domestic architecture. Numerous houses of immense quality were built that, in their form and construction, gave a new poetic expression to a particularly British conception of comfort and the architectural means by which this might be furnished. In the early decades of the twentieth century architecture entered a phase in which the technological expertise of structure, construction and environment was given new and explicit expression. These ideas were widely embraced by architects working in Britain, but were transformed by a particularly British sensibility to the influence of climate and by the characteristics of the British climate itself. The second half of the twentieth century was, in many respects, dominated by an approach to architecture that effectively disregarded the historic influence of climate, as mechanical systems for heating, cooling, ventilating and lighting were incorporated into sealed building envelopes. These designs were, by definition, hugely dependent on the consumption of energy sources derived from fossil fuels and, as such, came to contribute to the emerging environmental crisis. In exactly the same period, however, a deepening interest emerged in reconnecting architecture more intimately to climate in order to reap the benefits of the natural environment as a primary influence on the nature of buildings. The science of meteorology has now a vast armoury of instruments of observation and prediction that allow yet deeper understanding of how buildings might respond to and express the nature of the climate.

Of necessity, the scope of the book bridges the histories of architecture and meteorology. The research has encompassed extensive reading in these respective literatures. To bring a wider perspective to the project I have also delved into aspects of the history of art and of English literature. But, as always in research of this nature, the most telling sources are the buildings themselves, which stand as witness and record of the rich and constantly evolving connection of architecture and climate in Britain.



# Acknowledgements

Many people and institutions have aided the research for and production of this book. I should particularly like to record my gratitude to the following.

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Diane Haigh's deep knowledge of the architecture of the Arts and Crafts movement, and in particular of the houses of M. H. Baillie Scott, significantly informed the essay on that period of British architecture. Nicholas Bullock, my friend and colleague of many years, helped me broaden the background of my studies into the modern movement in Britain. My work on Alison and Peter Smithson received unique insights from conversations with Simon Smithson and his personal experience of life at Upper Lawn Pavilion. Simon and Soraya Smithson gave generous assistance in allowing access to the Smithson Family Collection and in furnishing invaluable images and documents. I must also thank Derek Sugden for invitations to visit his and Jean's wonderful Smithson house at Watford.

As with much of my previous research, the ideas for these essays have been developed and tested in lectures given to students in a number of schools of architecture. This is a process that I find particularly productive and, in particular, I am indebted to David Dernie, head of the Leicester School of Architecture at De Montfort University, and Richard Fellows, head of the School of Architecture at the University of Huddersfield, who



have welcomed me as visiting professor. I am also indebted to Alan Short and Koen Steemers, who have regularly invited me to contribute to undergraduate and postgraduate teaching in the Department of Architecture at the University of Cambridge.

The production of the book has been smoothed along by the help of Francesca Ford, Laura Williamson and Jo Endell-Cooper, my editors at Routledge, and I am indebted to Amy Tillotson, whose meticulous work in seeking permission to reproduce the images has been a boon to me.

I dedicate the book with love to my son and daughter: William and Mary.

Dean Hawkes,  
Cambridge,  
October 2011

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# Introduction

In 1955 Nikolaus Pevsner broadcast a series of radio lectures, the Reith Lectures, from the BBC in London. These subsequently became his book, *The Englishness of English Art* (1). The first lecture had the title ‘The Geography of Art’. In this Pevsner reflected on the validity of geography as a tool in understanding aspects of the nature of art and architecture. As part of the argument he examined the influence of climate on national character and, by extension, of the art of a nation, concluding that there is ‘a whole string of facts from art and literature tentatively derived from climate’.

In the wider literature of architecture the importance of the relationship between climate and building is commonly accepted, particularly in the discourse of so-called architectural science. Seminal texts include Victor Olgyay’s *Design with Climate*, Baruch Givoni’s *Man, Climate and Architecture* and, a recent addition to the field, *Climate and Architecture*, edited by Thorben Dahl (2). The concern of these and numerous other books is to define instrumental relationships between the physical characteristics of climate and the nature of buildings. They explain how to design buildings that will keep their occupants warm in cold places and cool in hot places and that respond to the diversity of the seasons. This is all of immense practical value and has been given further impetus with the emergence, in the last couple of decades, of the concern to make buildings more ‘environmentally friendly’, indeed to be overtly ‘climate-responsive’.

Here we have two complementary but quite distinct views of the relationship between climate and architecture. The first, from Pevsner, is firmly located in the humanities, the second, from Olgyay, Givoni, *et al.*, in the applied sciences. This distinction reflects the notion of ‘two cultures’ that was first articulated in 1959 by C. P. Snow (3). For over a decade, a theme in my writing has been to try and bridge this cultural gap in the study and understanding of the environmental function of architecture. The present book is a further instalment in this project. In *The Environmental Imagination* (2008) I explored the relationship of what I chose to call the *technics and poetics of the architectural environment*, through a group of essays ranging over the timescale of the nineteenth and twentieth centuries and, geographically, embracing western Europe and north America (4). My method is to explore

specific themes within that framework in the hope that these would, individually and cumulatively, connect the worlds of, in the terms of the book's subtitle, the technics and poetics of the architectural environment. Here I attempt to work on a similarly broad canvas in bringing together the culture and science of architecture's relationship with climate.

### **Terms of reference**

The present book is, in some respects, a development of the themes explored in *The Environmental Imagination*. Although buildings by Sir John Soane, Charles Rennie Mackintosh and the contemporary practice of Caruso St John helped to illustrate that argument, the works of many other British architects could also have served to support the thesis. Similarly, the link between architecture and climate was more implicit than explicit. Upon reflection, it seems to me that my argument could be fruitfully pursued by making a study of the relation of architecture and climate as this may be discovered in the history of British architecture.

In developing this line of research my aim has been to propose an alternative reading of the link between architecture and climate. In architectural science the method is invariably to represent buildings as a logical response to a pre-existing climate. This is, of course, the process that is observed in all practical circumstances. The climate exists. The building, in various manners and degrees, responds to this. But, in taking a historical standpoint, buildings may be seen, in some respects, both to represent and to interpret the climate that shaped them. What I am trying to show is that the meeting of architecture and climate is as much a question of history and culture as it is of technology.

This study is concerned with the architecture and climate of the British Isles and the timeframe extends from the last decades of the fifteenth century to the last decades of the twentieth. The nature of the British climate is comprehensively documented in terms of conventional meteorology. The Meteorological Office (5) is the principal source of contemporary climate data and there are numerous other substantial modern sources that are relevant to this study. There is also a vast resource in the field of climate history (6). In addition I have tried to draw upon the richness of English literature in providing insights into the representation of climate and its impact on human affairs (7). A further important source is the visual representation of the British climate in fine art, as painters have depicted both country and city (8).

The choice of this timeframe is, in part, related to the availability of meteorological records, but is mostly a matter of architectural history. To establish the ground of the study, I begin with Summerson's encyclopaedic *Architecture in Britain: 1530–1830* (9). In proceeding from the 'English

Renaissance' of the late Tudors and the Stuarts to the first decades of the nineteenth century, Summerson sets out an ideal framework for the present study. His narrative is carried through the study of the works of individual architects, and this is particularly important. There are important studies that examine the relationship between climate and vernacular building (10). My concern in this research, however, is to show that the influence of climate is also felt in the designs of those who consciously – perhaps self-consciously – practise the art of architecture. The account continues, from the conclusion of Summerson's study, through the nineteenth century and onwards towards the end of the twentieth, in order to capture other significant events in the unfolding relation of architecture and climate in Britain.

A final reference in helping to define the structure of the book is to the ideas and practices of the architects Alison and Peter Smithson. To characterize their response to the English climate, the Smithsons wrote (11):

The stress is on the needs for immediacy of response and reaction to the changeable weather of England; the almost constant need for full or partial weather protection from one quarter or another, a need that can change several times throughout an afternoon . . . Northern Europe involves us inevitably in sun acceptance, amelioration of climate and, above all, of exclusion of rain.

For architects of any environmental sensibility this kind of perception would follow, almost unconsciously, from the experience of living England. But the Smithsons frequently brought historical observation into play in support of their insights and, on environmental matters, a frequent reference was to the buildings of their Elizabethan namesake, Robert Smythson. The coincidence of name may have had some bearing on their initial attraction to his work, but this would, almost certainly, have been primarily in response to the overwhelming presence and substance of Smythson's buildings. Peter Smithson made observations regarding Robert's great house, Hardwick Hall, on a number of occasions (12):

In Hardwick New Hall there is a gallery which runs along the whole extent of the house. What's nice about (the plan) is that it indicates the thick spine wall, where the fireplaces are . . . and the perimeter bay windows that let in the light. . . . in the winter you have screens around the gallery against the fireplaces, and in the summer you moved into the bay windows.

I begin the essays that follow with a study of the Elizabethan houses of Robert Smythson and close with an account of the environmentalism of Alison and Peter Smithson.

### **Architecture and the British climate**

At the end of the sixteenth century Britain was in the grip of the 'Little Ice Age'. Throughout Europe in the years from 1560 to 1600 temperatures were markedly cooler and winds stormier than any experienced in the twentieth century. Specifically, the 1590s was the coldest decade of the entire century (13). In 1590 Robert Smythson (14), in collaboration with Elizabeth, Countess of Shrewsbury, began the construction of one of the most remarkable buildings in Britain. On an exposed Derbyshire hilltop, 179 metres above sea level, arose Hardwick Hall (Plate 1). Elizabeth, or Bess of Hardwick as she is almost always known, first occupied the house in October 1597. The house is remarkable for many reasons, but for present purposes we should note the apparent contradiction between its location, form and construction and the extreme climate of the time. Hardwick, which is visible from miles around, quickly acquired the appellation 'Hardwick Hall, more glass than wall', and with its strict symmetries, flat roofs and enormous windows on all faces, would seem at first sight to defy climatic logic. But architecture is a complex business and one of the lessons of Hardwick and of other designs by Smythson, such as his remarkable Wollaton Hall near Nottingham and Bolsover Castle, close by Hardwick, is that nature and art may be reconciled in surprising ways. Behind their apparent formal abstractions these buildings reveal subtle accommodations to the climate and to the needs and complexities of human inhabitation.

The seventeenth century saw the development of scientific instruments for many purposes. Amongst these were the first devices for measuring and recording elements of the climate, and by the middle years of the century the first reliable thermometers and barometers had been demonstrated (15) and thus allowed subjective experiences to be supplemented by quantification. This was to have a significant influence on the understanding of climate and to promote the application of new knowledge to practical affairs. Christopher Wren was both scientist and architect (16). In 1936, Summerson wrote revealingly about the influence of Wren's scientific mind on his architecture, and more recently the question has been revisited at length by the historian of science J. A. Bennett (17). Neither, however, addresses the possibility that the scientist might have developed a particular appreciation of climate and that this might be manifest in the fundamentals of his architecture. In *Heavenly Mansions* Summerson provides an intriguing juxtaposition between an engraving of a 'weather-clock' devised by Wren, probably dating from 1663 or shortly after, and Loggan's engraving of the south façade of the Sheldonian

Theatre (1662–1663) (18). This coincidence of dates suggests that there is a case for interpreting Wren's architecture from a climatic viewpoint. The luminosity of St James, Garlickhythe, often referred to as 'Wren's Lantern', or of the great library at Trinity College in Cambridge (Plate 2) lend support to this reading.

Summerson defined the years from 1710 to 1750 as the 'Palladian Phase' of British architecture, writing, 'During this period . . . a set of distinct ideas as to what was good in architecture became widely held, and standards, based on the acknowledged excellence of certain architects and authors, were widely endorsed.' (19). The principal documentary influence on English Palladianism was Palladio's *I quattro libri dell'architettura*. Published in Italy in 1570, this was first translated into English by Giacomo Leoni in 1715–1720, followed in 1738 by Isaac Ware's more accurate translation, *Andrea Palladio's Architecture in Four Books* (20). In the First Book, Palladio provides explicit guidelines concerning a number of matters that are directly related to climate. Detailed prescriptions are given for the dimensions of windows in relation to the size of rooms in order to ensure sufficient daylight and to avoid too much heat or cold according to the season. Formulae are also given for the location and dimensions of chimneys. Bringing an architecture conceived in the climate of the Veneto to the cooler conditions of Britain meant that these relationships of solid to void, window to room were invalid. The pragmatic British easily understood this, and a defining characteristic of British Palladianism is the climatic fine-tuning that it demonstrates. This can be identified in the buildings themselves, at Houghton Hall, Chiswick House (Plate 3) and Mereworth, but theoretical consolidation may also be found in a number of eighteenth-century treatises by, amongst others, Colen Campbell, Robert Morris and William Chambers (21). Awareness of climate was widespread in eighteenth-century England as part of a growing interest in natural history, primarily amongst the gentry and clergy. Of these, one of the most celebrated was Gilbert White, the curate of the village of Selborne in Hampshire. The author of *The Natural History of Selborne* (22) kept, from 1768 to 1793, journals in which he recorded daily observations of rural life, always against the background of descriptions of the climate. These provide vivid evidence of the persistence of the Little Ice Age at this period, recording on 13 February 1784 that 'This evening the frost has lasted 28 days.' And, on 21 June, the summer solstice, 'Dark and chilly rain. Cold and comfortless.' But the summers could be warm, as, for example, when White recorded on 24 June 1786, 'Wheat is I bloom, and has had a fine, still, dry warm season for blowing.' (23)

The climate of a city inevitably differs from that of the surrounding countryside. In 1661 John Evelyn published *Fumifugium or The Inconveniencie of the Aer and Smoak of London Dissipated. Together with some Remedies humbly*



*Proposed* (24). There he described at length the horrors of the ‘Hellish and dismal Cloud of SEA-COAL’ that covered the city, the city of Christopher Wren. But even the campaigning authority of Evelyn failed to remedy the problem and by the beginning of the nineteenth century the problem was, if anything, even worse (25). By this time meteorological observation, whilst still largely undertaken by amateurs, was on a substantial scientific foundation. A major figure was Luke Howard, whose *The Climate of London* (1818 and 1833) not only collated extensive data on the climate of the metropolis, but drew precise comparisons between the city and the surrounding countryside (26). As cities grew rapidly and new techniques for building became commonplace, new relationships were forged between architecture and climate and, in particular, with the polluted urban climate. The design of newly conceived building types – the gentlemen’s clubs, public libraries and the great museums – incorporated new devices for central heating, mechanical ventilation, and artificial lighting. These extended the practical hours of inhabitation of buildings, both by day and night and throughout the seasons of the year. They also made it possible to create cleaner and healthier environments within a building as a refuge from the conditions of the city without. In parallel with developments in practice, a number of important ‘theoretical’ texts by authors such as Walter Bernan, D. B. Reid and Charles James Richardson (27) were published. To the end of his life, Sir John Soane continued his experiments with heating installations, and these proved essential to his designs for the Bank of England and the Law Courts at Westminster. Following the disastrous fire of 1834, the ventilation of the rebuilt Palace of Westminster became the subject of considerable debate and dispute, at the centre of which was Reid in his role as a consultant to the architect Charles Barry (28). Many of the significant architects of the time readily incorporated these devices in their designs. Particularly important examples include gentlemen’s clubs, such as Charles Barry’s Reform Club (Plate 4), great museums such as Alfred Waterhouse’s Natural History Museum and highly specialized structures such as the Reading Room at the British Museum (29).

Towards the end of the nineteenth century British domestic architecture gained an international reputation (30). Inspired by the theories of William Morris, a group of talented architects created an architecture that had its roots in both the traditions and contexts of vernacular building. Philip Webb was Morris’s own architect in making the Red House (1859) and he and his exact contemporary, Norman Shaw, prepared the ground for the outpouring of remarkable houses by a younger generation of architects, including C. F. A. Voysey, W. R. Lethaby, M. H. Baillie Scott, Edward Prior, Parker and Unwin, and Charles Rennie Mackintosh (31). The majority of these houses were sited in leafy suburbs of the expanding cities or, in a number of cases, deep in the countryside made accessible by the development

of the new commuter railways. In this respect they may be interpreted as marking a strong contrast to the buildings in the inhospitable climate of the industrial city. But climate, however benign, may be shown to have a strong influence on their form, planning and materiality. Voysey wrote emphatically that 'We are not Greeks, nor have we a Grecian climate . . .' and went on to offer a poetic interpretation of the significance of climate in defining the essence of an English architecture. ' . . . a careful study of our climate makes us emphasise our roofs to suggest protection from weather. Large massive chimneys imply stability and repose. Long, low buildings also create a feeling of restfulness and spaciousness. Small windows in relation to wall space suggest protection' (32). A more specific climate response of Arts and Crafts architects was their commitment to achieving good orientation. For example, Parker and Unwin wrote, ' . . . no sacrifice is too great which is necessary to enable us to bring plenty of sunshine into all main living rooms' (33). Similar statements may be found in the writings of Voysey, Baillie Scott and others, and their buildings consistently demonstrate their respect for the principle (Plate 5). In the field of climate science, the British Meteorological Office was established in 1854, principally to provide forecasts for mariners and, in 1861, began publishing daily weather forecasts in the national press (34). At the same time, the rigours of the Little Ice Age had now finally disappeared and there emerged a pervading sense of climatic well-being. It is, perhaps, significant that Jane Brown entitled her book on the partnership of Edwin Lutyens and Gertrude Jekyll, *Gardens of a Golden Afternoon* (35).

In 1929 Le Corbusier proposed a new relationship between architecture and climate when, in one of the lectures he gave on a visit to Buenos Aires, he declared, 'Every country builds its houses in response to climate. At this moment of general diffusion, of international scientific techniques, I propose only one house for all countries, the house of *exact breathing*.' (36). It has been shown, however, that, in this respect, Le Corbusier's practise frequently contradicted his rhetoric (37). Throughout his life many of his designs, from the white villas of Purism to the Indian works of his later years, were finely calibrated to specific conditions of climate. And an acute sensibility to matters environmental – to *milieu* lies at the heart of *Le Poème de l'Angle Droit* (38). The influence of the Arts and Crafts movement upon international Modernism has been widely argued in both early and recent writings (39). In most cases the connection between the two movements is seen in terms of the influence of the material and even moral theories of the Arts and Crafts upon Modernism. When, however, we consider the relation between Arts and Crafts and Modern architecture in Britain, the influence of the seemingly benign climate becomes strongly apparent. The beginning of radio broadcasts of weather forecasts was firmly established by the foundation of the British Broadcasting Company – later the British