History of Preventive Conservation **Jo Kirby Atkinson**

Summary

Introduction

To a large extent, preventive conservation as we understand it today has its origins in our long-standing concern for the care of objects as a part of everyday life. Whether an artefact is an everyday item, of the sort found in most households, or something of great cultural significance, it requires attention to keep it in good condition, to enable it to perform its function. This would not have been called preventive conservation; it might have been called spring cleaning, or simply correct storage, but the intention was similar.This was as important centuries ago as it is today. Many of the examples to be shown as illustrations are European: much of our knowledge of damage caused and the means of prevention are derived from the technological advances that took place initially in Europe in the eighteenth and nineteenth centuries. But participants may well have their own specific examples in mind.

Early history

While it should be acknowledged that not all cultures have viewed the preservation of artefacts as any more significant than the preservation of some more intangible aspect of their heritage, in most communities, and particularly in those where collections of objects – archives, libraries, treasuries, museums – have been formed over time, attention has been given to maintenance and conservation of artefacts. Treasuries were built to house precious items in cathedrals, palaces and public buildings from early times. An interesting example is provided by the Japanese *kura*, intended to store valuable commodities or precious or religious items. The outstanding example is the Shōsōin at Tōdai-ji in Nara, built between 756 and 759 AD; many of the artefacts housed date back to the time of its construction. The traditional building material in Japan is wood, vulnerable to fire damage. The Shōsōin is a wooden building, but it was constructed using logs triangular in cross section, thicker and more durable than those usually used. It has a raised floor, in this case of timber, a feature quite often found in *kura* as the passage of air under the building keeps the interior cool and insects, rodents and other pests are prevented from entering.

Damage by pests, mould, dust, sunlight and damp was as unwelcome four or five hundred years ago as it is today and steps were taken to mitigate it. For example, paintings in northern Europe might be protected from light and dust by curtains or sometimes shutters – wings – that covered the main panel (although there could also be an important ritualistic element in these cases). Books were kept closed or rolled, depending on their format. Plants (such as wormwood, lavender), poisonous minerals (such as orpiment) and other substances (such as camphor) were used to control moths and other insect pests, rats and mice. Similar attempts at control could be found in any country.

Technological change: the Industrial Revolution and scientific developments

The other factors contributing to the development of preventive conservation have been, firstly, the growing recognition of the different agents causing damage and, secondly, a gradual understanding of how these agents affect different materials. The Industrial Revolution in Europe and the USA, the effects of which spread gradually across the rest of the world, brought about considerable technological developments – artificial lighting, more efficient heating, efficient manufacturing methods, rapid methods of transport – but also an increased possibility of damage to both buildings and their contents from these same developments. At the same time, however, progress in the scientific understanding both of materials and of the agents that might cause damage, taking place throughout the nineteenth and twentieth centuries and continuing today, has enabled the care of cultural heritage to be carried out more effectively and with a greater understanding.

The growth of collections

Libraries existed in Classical Roman times and were maintained in later centuries by monasteries. Collections of paintings and objects – the Cabinet of Curiosities or *Schatzkammer* – were developed in Europe at the end of the sixteenth century and grew into the museums and galleried of today. The growth of large museums, galleries, libraries and other collections over the last 150 years or so has provided an impetus for many of the developments toward the control of lighting, temperature and relative humidity and pollution in particular. These, and also the control of pests, are the agents to which most attention has been given historically. A brief account will be given of some of the principal historical points of interest, summarised below.

Pollution

Pollution from manufacturing trades was a recognised problem in urban areas in Europe (and, no doubt, elsewhere) long before the late eighteenth and nineteenth centuries. Certain trades were confined to certain parts of towns because of the smells or unpleasant products generated; although these were not necessarily damaging to artefacts they did cause public nuisance. An increase in the burning of coal was, however, a matter of greater concern in seventeenth-century England because of the dirt and sulphurous fumes.

By the mid-nineteenth century, with the growth of heavy industry burning more coal and producing more dirt, sulphur-containing gases and other waste, the effects on public collections situated in urban centres were a matter of great concern. This is shown, for example, by the Select Committee reporting in 1850 to the British Parliament on the National Gallery, London, and the condition of the paintings, followed up by a further report in 1853. The report recommendations included the suggestion that pictures of moderate size should be glazed and the backs of the pictures covered as protection against dirt and impurities.

Light

The fact that exposure to light could cause damage to textiles, furniture, paper and paintings had long been known; for example, curtain materials lost strength and became damaged and, most obviously, the colours of dyes and some pigments faded. The fact that some dyes were less permanent to light and poorer in quality than others had been known for centuries: in Europe, legislation and guild regulations controlled their use. Similarly, it was known that some pigments were more likely to fade than others.

Already during the eighteenth century in Europe, some scientific investigations into the properties of pigments, including their response to the effects of light, were carried out, although these early researches were more concerned with the properties of the pigments than with those of light. Probably one of the earliest relatively systematic studies was that of the English colour maker George Field, dating from the first decades of the nineteenth century. He exposed samples of pigments, made by himself and obtained from other people, to sunlight and the sulphurous fumes from a lavatory (methods of testing also used by others) and noted the results. These were developed into useful tables, first published in 1835, showing the permanence of pigments to light, and also the influence of other factors (damp, sulphur-containing gases).

Following research into the nature of light and the electromagnetic spectrum during the nineteenth century, more effective investigation into the science of the action of light on works of art and the materials from which they are constructed could be carried out. One of the most significant was the investigation into the action of light on watercolours, carried out by Dr W.J. Russell and Captain W. de W. Abney between 1886 and 1888. Sunlight was the source of light for the experiments. By using red, green and blue glass filters the authors were also able to take account of the relative effects of incandescent gas lighting and electric arc lights. They also considered the additional effects of dry and moist air.

By the 1950s, the properties of different light sources, such as the recently invented fluorescent lamps, were being studied in greater detail and concerns were raised about the damaging effects of ultraviolet radiation: photochemical damage is not limited to that caused by visible light. In addition, it was recognised that humidity in general increased the rate of deterioration, as did polluting gases in the atmosphere, much as George Field had observed a century earlier in a more limited way. Writers such as Robert Feller, Garry Thomson and others observed that the total amount of light received by an object was the significant factor, thus storing items in the dark when not on exhibition or when a museum is closed is to be recommended. Work had also been done on appropriate levels of illumination, based on the sensitivity of the human eye and its ability to accommodate to a wide range of intensities. This underlies the suggestion of levels of illumination suitable for different classes of material.

Relative humidity and temperature

The connection between an understanding of the behaviour of the materials from which artefacts and the buildings that house them are made, informed by scientific investigation, and how best to look after both the objects and the buildings is also demonstrated in the case of relative humidity and temperature. Methods of heating or cooling in houses had always been required for human comfort, but they were also important for certain trades to be carried out efficiently and the needs of manufacturing and commerce played a significant role in the development of efficient heating and ventilation systems. To give an example from the English textile industry, a relatively warm temperature was needed for efficient spinning of cotton and silk to avoid breaking the fibres, which meant stopping the machinery, and during the eighteenth century, warm air heating systems were devised for textile mills. These predate the steam heating systems developed and used early in the nineteenth century, notably by the architect Sir John Soane in some of his public buildings, including the Bank of England and Dulwich Picture Gallery.

In hotter regions of the world, systems for cooling buildings were required. The ground floor of the main building of the former Marine Police Headquarters in Hong Kong, built in the 1880s, was constructed approximately a metre above the ground and small openings all round the building acted as ventilation portals, permitting a flow of air, cooling the interior and also preventing decay of the wooden floor joists. High ceilings and large windows also helped cool the building in hot, humid weather.

The need for ventilation as well as heating in public buildings was also recognised and the system for moistening, drying and cooling the air in the British Houses of Parliament described by David Boswell Reid in 1844 is one of the earliest examples of air conditioning. In 1853 a similar system was suggested for the National Gallery in London as a possible solution to the dirt caused by air pollution, but this was not carried out. Air conditioning was only introduced a century later, in 1950, initially in one gallery, as a result of observing the good condition of paintings stored in conditions of constant temperature and relative humidity in the Manod slate quarry near Blaenau Ffestiniog, Wales, from 1941 to 1945, during the Second World War.

Systems providing heat and some humidification were installed in other museums rather earlier. In 1892, a commission investigating conditions in European museums recommended that heating should contribute to the preservation of the pictures, with an air humidity level maintained at 50% saturation; following from this, the Alte Pinakothek in Munich began the installation of a low-pressure steam heating system in the early 1890s. In the USA, the Boston Museum of Fine Arts introduced humidification in 1908. After observing the effects of variations in relative humidity on objects in the collection, the appropriate value for most objects (apart from armour and early Egyptian art works) appeared to be 55–60%, regardless of temperature and the time of year.

By the 1930s, many collections, particularly in the USA, had some degree of temperature and/ or relative humidity control, or were investigating the possibilities of air conditioning or other forms of environmental control. A survey of museums in Europe and North America, published in 1960, showed that most preferred a range of values for relative humidity around 40–70%, generally within or overlapping the 50–60% range, 50% being recommended to avoid desiccation of materials such as parchment, 60 % at the upper end to avoid mould growth. This useful survey also described the equipment available for measurement or recording relative humidity, as well as that available for dehumidification, humidification and air conditioning.

The relative humidity value of 58% maintained in the Manod quarry by heating alone (with a temperature of 17 °C) was based on pre-war research carried out by the Forest Products Research Laboratory on seasonal variations in the moisture content of blocks of a selction of woods used in European panels and other art works placed in rooms in the National Gallery. The results showed that the average moisture content of the wooden blocks throughout the year was about 11%, compared with their dry weight. This is equivalent to a relative humidity value of 55–60% for this particular building. The National Gallery thus chose control around this point when air conditioning was introduced in 1950.

More recently, very much more scientific investigation has been carried out on the behaviour of the materials from which artefacts are made, much of it during the 1990s and most of it on model systems. This has informed the more recent discussions on the need for close control of environmental conditions and how tolerant to apparently inappropriate conditions objects are in practice. There are also many questions to be asked on how appropriate it is to install an air conditioning system, given the cost, the nature of the building itself and local climatic conditions. These and more detailed discussions of lighting, pollution, pest control and other topics are the subject of other lectures.

Some further reading

Atkinson, J. Kirby, ‘Environmental conditions for the safeguarding of collections: A background to the current debate on the control of relative humidity and temperature’, *Studies in Conservation*, 59, 4, 2014, pp. 205–12.

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Staniforth, S. (ed.), *Historical Perspectives on Preventive Conservation*, Los Angeles: Getty Conservation Institute, 2013.

Thomson, G., *The Museum Environment*, 2nd edn, London: Butterworths, 1986.