Forbes Prize Lecture

The Forbes Prize was established in 1958 to honour Edward Waldo Forbes, Director Emeritus of the Fogg Art Museum, Harvard University, and the first Honorary Fellow of IIC. It is awarded by the Council for conspicuous services to conservation and the recipient customarily delivers a lecture during the Institute's international congress. The recipient of the Forbes Prize 2004 was Andreas Burmester.

Andreas Burmester studied chemistry and mathematics in Tübingen (Germany). He finished his thesis in organic chemistry in 1979, by which time he had realized that his main interest lay somewhere between science and art. A research project on Oriental lacquer was accompanied by study of history of art in Berlin. In 1983 he was appointed as a scientist at the Doerner Institut in Munich, becoming head of the scientific department in 1987 and director of the Institute at the beginning of 2003. Since 1996, he has lectured at the Ludwig-Maximilian and Technical Universities in Munich, receiving the official qualification as a university teacher in conservation in 2001 and, in 2002, becoming a 'Privatdozent' at the Technical University in Munich, where he lectures on preventive conservation and other topics. His main interests are in pigment history, primary sources and preventive conservation. He serves as a member of the Scientific Consultative Group of the National Gallery, London and the editorial board of *Reviews in Conservation*. In 2002 he was elected an ordinary member of the IIC Council, and in January 2004 a vice-president.

Andreas Burmester in front of Lovis Corinth, Self-Portrait of 1924 (Neue Pinakothek Munich)

VISIONS FOR A NEW MUSEUM: THE MUSEUM BRANDHORST

It is a great honour for me to give this lecture, although I am doing the same as any of you, simply fulfilling my duties and living my vocation. Although I am free to choose any subject, we are at a conference about new museums and modern art. Because the conservator's involvement in museum design is still not fully recognized as an important task for our profession, I would like to devote this – my Forbes Prize Lecture – to the topic of museum design, a subject that deserves far more attention in our field.

My understanding of museum design is much influenced by the Alte Pinakothek, or, more accurately, by its architect, Leo von Klenze (1784–1864), who developed this building in the 1820s. There is broad agreement that he concentrated on the functionality of the museum. Clean air, fire protection, good viewing conditions and climate were all major concerns for this influential architect, and it is this functional approach that I would like to take.

If you go back into the history of museums, the development of the functional side can be seen as a spiral of causes and actions. I do not intend to describe this spiral in detail, but there are some milestones that have conservation implications. The first point is that poor viewing conditions and the need for more exhibition space led to the windows being moved from the walls to the ceiling. Second, more visitors, longer opening hours and a lack of daylight gave rise to larger roof lights. In a third step, to counteract poor air and heat, high-level ventilation flaps were used to introduce fresh outside air. As these allowed rain or smog to penetrate the galleries, they had to be closed again and the lamented foul air returned, so that conservation measures such as the glazing and backing of paintings had to be taken. If we continue on our spiral, uncomfortable temperatures were combatted by central heating, and the need for more light forced the

introduction of gas and electric lighting. Simple humidification systems were next needed as a measure against damage to panel paintings and furniture by heating. Later still, technical progress smoothed the way for air conditioning, which was originally a measure against outside smog and only later included the control of temperature *and* humidity. Finally, the magic potion of air conditioning permitted new building materials, such as glass, concrete and steel. This is the point we are at today.

At the end of this spiral of causes and actions, we are now confronted with new challenges; with limited resources, unsustainable buildings, incompatible uses, and high maintenance costs. Most of them affect our conservation goals and they certainly increase the risk for the objects we care for. We have to find an answer. The situation is complex, and I shall try to develop my personal vision of how to cope with this situation. I intend to use a museum that has yet to be built as a surface on to which to project my vision. It is just the right moment to do this, because a new museum building – the fourth Pinakothek – should be under construction from 2005. This new building will one day house the generous donation of Annette and Udo Brandhorst, and although I would love to discuss their collection of late twentieth-century and contemporary art [1], we will focus on the building itself.

Where will this new building go? The area in one corner of the grounds of the other three Pinakothek buildings is problematic; it is noisy, and too long and narrow. The neighbourhood contains ugly university buildings, the recently opened Pinakothek der Moderne [2, 3], the ruins of military buildings, a yet-to-be-built administration unit for the Munich Cabinet of Drawings and Prints, and an architecturally important house from the early 1950s by the Munich architect Sep Ruf. The Museum Brandhorst's design reacts to this situation. It will have a simple form (Figure 1): a long body, a 23 m high north-facing corner, few visible windows, and the façade will be made of glazed ceramics that are colourful up close, but give a pointillist impression from a distance. It just fits between the street corner and the ruins; for more information see www.museum-brandhorst.de.

Figure 1 *Computer simulation of the Museum Brandhorst from the south-east. Photo: Sauerbruch Hutton Architects.*

Instead of showing you around the building floor by floor as the architects Matthias Sauerbruch and Louisa Hutton would do, I would like to discuss some of the functions, and in doing so you will understand the form, since form follows function, which is often not the case in museum design. Explicitly, four 'chapters' will allow us to understand where the design brushes against the *Zeitgeist*, where it swims with the current, and where the conservation-sensitive points lie.

Against the Zeitgeist

First, we will deal with light and climate in current museum design. Most day-lit museums gain plenty of daylight through roof glazing. The Munich Pinakothek buildings have a long, but difficult tradition with daylight. Daylight is vivid! Daylight changes its colour during the day! Daylight makes every visit a new experience! Tim Padfield would add that daylight is the most efficient of all the light sources we have for museum lighting, with about 50% of total solar radiation falling in the visible range. As an unpleasant side effect, solar radiation heats up the space below roof lights, and the galleries in general. I think that the combination of daylighting and inappropriate museum architecture now only survives because of air conditioning; without air conditioning, we would have abandoned this day-lit concept a long time ago.

In designing the Museum Brandhorst there was broad agreement that daylight should be used to the greatest possible extent. In the upper floor, the roofs, roof spaces and laylights guarantee homogeneous lighting of all the walls, floors and corners. Simulations indicate that the walls will show an even distribution of the light. For 62% of the time, more than 300 lux of daylight will be available, which then has to be reduced in some way. In our case, this daylight is diffuse light only, as in an innovative approach, specially designed outer grids will prevent the sun from shining directly into the building and allow only indirect diffuse daylight to pass. Even more important, the grids prevent heat entering the building and offer an additional, physical, security layer. Electric heating of the outer grids prevents snow from settling. The roof lights below the grids offer insulation and ultraviolet protection. Mechanical louvres allow the daylight to be dimmed and light to be excluded from the galleries outside the opening hours, while fluorescent lamps provide artificial light. The laylights are constructed

from single elements; every element has two layers: the upper collects the dust and the lower diffuses the light and prevents a direct view of the roof space. Between these elements there is some space, which allows the 'used' air in the galleries to enter the roof space, from where it is extracted. In contrast to our other buildings, the gallery and roof space are physically connected in this way. Additional light sources or art objects can be hung through the slits between the laylight elements.

Air conditioning is seen to be beneficial for conservation. However, active air conditioning requires permanent energy input and sustainable maintenance. Both are limited resources: what will happen if an administrator decides to switch off the air conditioning due to financial problems, or if the decision makers – who are rarely conservators – hear about the wider humidity and temperature ranges promoted by some of us? Or, even worse, if air conditioning is seen in a wider context, one in which the air-conditioned museums of today are not acceptable from an environmental point of view. Just to give you one figure: the three Pinakothek buildings have an electricity bill of around one thousand times the bill of my large flat. Much of this electricity is used for air conditioning or is transformed into heat by the artificial lighting, which causes the air conditioning to become active.

How should we deal with this problem? As mentioned above, one recent approach was to tell the museums that the situation could be improved if the ranges for relative humidity and temperature were widened. In my view, this approach neglects the European lesson of the Second World War quarries where we compulsorily learnt that objects behave well in a stable climate. This approach also neglects the European lesson of cloisters, castles and churches where objects were kept safely for centuries until they were taken into early museums. In addition, this approach neglects my private lesson of the well-preserved condition of all our objects in the air-conditioned Pinakothek buildings, where we aim for narrow ranges for relative humidity and temperature. In short, the more stable the climate, the less change in equilibrium moisture content, the less change in volume, the less damage. It is a simple equation! Therefore, instead of changing the preservation standards and turning the spiral backwards, I would like to see the museum design changed and the spiral developed further! To start with, I have identified five points for a solution: the solution has to be compatible with my environmental convictions, it has to create a sustainable climate, it has to fit our conservation needs more closely, it should need less capital investment and, finally, it should have far lower operating costs.

I have experienced many cases where conventional museum air conditioning destabilized thermally stable buildings. In those cases, not the building itself but the air conditioning turned out to be the problem for the objects. So, maybe, conventional air conditioning is not the answer. In my eyes, the key problem in museum air conditioning is that temperature and humidity are provided through the same medium – the air blown into the galleries and stores. I never understood why air, with its low heat capacity, is used to transport heat. It is, however, an excellent transport medium for water vapour, while liquid water is an excellent transport medium for heat: so why not use each to best effect? As a first step in the Museum Brandhorst we tried to separate the two parameters, temperature and humidity; in a second step, we talked about costs.

In the galleries and other public areas, most of the outside walls and floors are 'active' (Figure 2). Some years ago, this type of active structural component became common in Germany, and it needs explanation. A system of water pipes is embedded into the outer walls and floor. The water serves as a heating or cooling medium, which has a clear conservation benefit. The inertia of the heavy structural components results in a stable room temperature that simulations show will be in the range 18.5 to 20.5°C (assuming 20 visitors per 100 m²). Conservators do not like water, but do not fear! From other museums, we now know that failures can be prevented by a careful check of the pipes before the walls are closed and the use of proper drills subsequently. Moreover, the pipes are grouped into small units that are checked separately in the event of a leak.

In accordance with my environmental convictions, the energy required to heat the water running through the pipes is gained from groundwater by means of a heat exchanger. This groundwater is available abundantly because the Museum Brandhorst is built into a broad current of groundwater. This groundwater is heated by the waste heat of the Pinakothek der

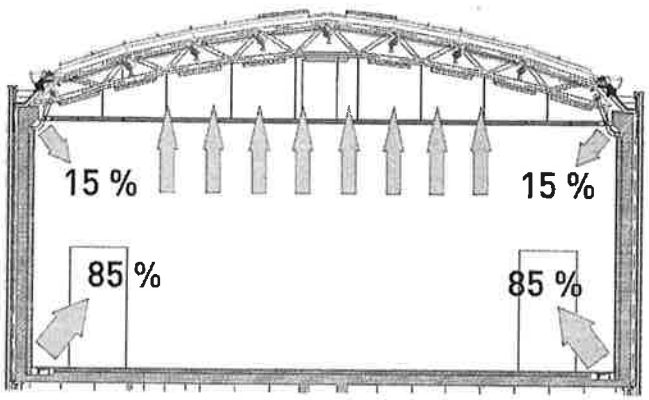

Figure 2 *The climate control concept for the galleries, with active walls and floors. Photo: Sauerbruch Hutton Architects and the author.*

Moderne to a temperature of up to 27°C and is, therefore, a cheap heat source. However, due to the internal loads from visitors or electric lighting, cooling by the air conditioning is far more important. Here, clearly, electrical energy is required to operate the heat pumps.

Centrally conditioned air from an air conditioning unit provides the required humidity. As in the Pinakothek der Moderne [3], we chose an upwards displacement air conditioning system (UDAC) with a low air speed. The main disadvantage of UDAC is that rather large air outlets are required. These will be located close to the walls in the form of perforated wooden floorboards. Through these floorboards, 85% of the incoming conditioned air will slowly stream out. Another 15% will be provided from the ceiling (Figure 2). The perforated zone also helps to keep visitors away from the walls. For any kind of wall-floor related installations, some solid floorboards can be substituted without any major problems for the room climate. Assuming 20 visitors per 100 m², simulations promise a homogeneous distribution of the relative humidity between 48 and 51% and an air speed between 0.04 and 0.26 $m \cdot s^{-1}$, which is about a tenth that from conventional air conditioning. Museums with conventional air conditioning frequently have high air-exchange rates, sometimes more than four complete air changes per hour. In practice, our museum has good experience with far lower rates, which in turn saves energy. In the Museum Brandhorst, an average air-exchange rate of two per hour is expected.

Finally, a comparison between different variants (with active walls, ceilings or floors, heated or cooled by water or by air, and in combination with UDAC or conventional air conditioning systems), shows that our solution is not only far cheaper than conventional air conditioning but also has lower operating costs (Table 1). Nowadays, high operating costs are killer arguments in museums and sometimes reach a point where the air conditioning is simply switched off.

Table 1 *Cost comparison for five different climate control schemes* [a]

Number	System	Investment (k€)	Operating costs (k€)
1	Active floor (water); UDAC [b]	2294	79
2	Active floor (water); Active ceiling (water); UDAC	2336	79
3 [c]	Active wall (water); Active floor (water); UDAC	2657	57
4	Active wall (air); Active floor (air);	2666	78
5	Full air conditioning	4123	101

a. Source: Ingenieurbüro Ottitsch, Munich
b. Upward displacement air conditioning
c. Scheme selected for the Museum Brandhorst

In summary, our new concept is a milestone. The concept is not only against the *Zeitgeist* of current museum design, but also promises a multiple breakthrough for us as conservators. I repeat, our solution excludes direct sun and heat, my vision guarantees walls and floors of homogeneous temperature, it provides separately controlled humidity with low air speeds and high homogeneity, it saves energy, investment and operating costs, it is more environmentally friendly, and it promises to provide sustainable conditions for the benefit of the objects.

With the current

However, my vision is slightly tainted, as there are three points where I would have loved to act against the *Zeitgeist*, but finally had to swim with the current. These are storage, a possible lack of foresight, and events. All three may affect the collection, or they may not – it is the old game of risks.

Of simple shape, colourful, day-lit, cool and connected to the groundwater! This last point touches an area of serious concern. The steadily growing Brandhorst Collection will have five depositories: two large stores for paintings, another for photographs, a fourth for electronic media and, finally, a large store for three-dimensional objects. The last is organized as an open space for objects whose shape does not allow easy storage; one just puts them in where they will fit. But all the depositories will be located below groundwater level (Figure 3), so what will happen if the concrete container leaks, or

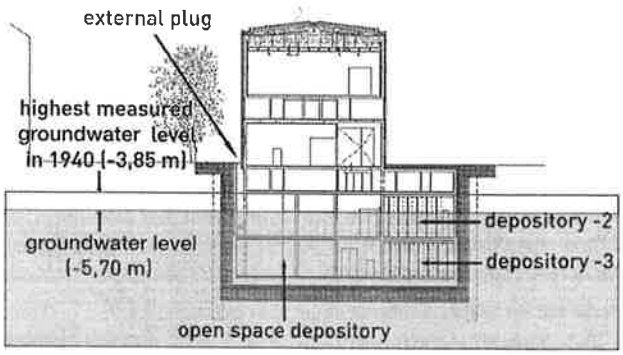

Figure 3 *Section of the Museum Brandhorst with depositories below groundwater level. Photo: Sauerbruch Hutton Architects and the author.*

in a disaster? Will we be able to evacuate the building? What will happen if there is a prolonged lack of energy or staff, or even worse, neglect? Examples, such as the recent Dresden flood, or the fate of the Alte and Neue Pinakotheken during and after the Second World War when heavy objects could not be evacuated from the cellars, may illustrate my fears. All the depositories are located on levels –2 and –3 and, normally, a heavy-load lift will be available. But during a power failure in the museum, electricity will be supplied via an external plug. If this fails, there is no way to evacuate objects from level –3, and only the paintings could be removed from level –2, via an open space, the so-called 'painting slit' in the staircase.

The recent decision to build depositories within a courtyard at the Dresden Albertinum and the Basel Schaulager clearly point to solutions for the future: separate, external storage spaces above groundwater level. In the long term, I envisage an additional simple building somewhere between the Pinakothek buildings, which might house a storage and technical service centre, photographic and conservation studios, rooms for catalogues and machine storage; that is, rooms for all those functions that have no lobby. I admit that external storage will result in transport to and from the depository and will increase the risk of handling; in the end, we conservators have to choose between cholera and the Black Death, between the low but disastrous risk of invading water and the periodic risk of transportation. However, in the case of the Museum Brandhorst there was no decision to be made; the narrow shape of the plot of land for this building did not allow any separation of the functions, however desirable. My concerns are just a fear, difficult to quantify, a common situation in preventive conservation.

The second point touches a possible lack of foresight. There is no doubt that the Museum Brandhorst will successfully present the rich collections of paintings, sculptures, installations and electronic media. The large Cy Twombly room, for example, will certainly attract the public, as will the other galleries. So, what is wrong? In my eyes, museums are memory containers, the memories of our past [2]. But we planned yesterday and build today or tomorrow, so that by the time we open in the future new developments in contemporary art might demonstrate how restricted yesterday's imagination was. I encounter this restricted imagination in many modern art museums, and I would not know, for example, how to cope with the foggy installation by Olafur Eliasson at Tate Modern in 2003 or the 300 tons by Santiago Sierra in 2004 at the Kunsthaus Bregenz. Both would try our vision of the future to the limits. This lack of foresight always has conservation implications, because the building might one day be used for something for which it was not built and, in my experience, unintended use creates risks for the exhibits. Again, my concerns are just a fear, difficult to quantify, a common situation in preventive conservation.

In addition, there is a final point to consider. Storage may have no lobby, but partying has a lobby! Let's have a party! Today's fusion of our museums with flexible venues for any kind of event is born from the hope of increased public awareness and financial wealth. These events may be a concert, the launch of the new BMW, or a private birthday party. Conservators dislike this fusion of museum and event venue, but in my case, it is far more than dislike: museums today seem to adapt to society's diversity instead of behaving asynchronically [4] and shaping their profile as memory containers [5]. I would prefer this, but what a conservator or museum scientist dislikes or prefers is irrelevant in the eyes of museum decision makers. Nonetheless, we have to state that the situation requires different buildings. This is simply because events require different facilities to galleries. Different measures must be taken in case of fire and other disasters. Legally laid down escape routes conflict with high security levels in the exhibition areas, while deliveries through the galleries or cooking in the public spaces conflict with conservation needs.

To avoid all these conflicts, the Museum Brandhorst tries to draw a sharp line between events on the one hand and exhibitions and storage on the other. The separating line is situated between the head of the building (the entrance hall) and all other rooms. But, although the entrance hall with its museum shop and restaurant is certainly a nice place, the interesting architecture of, for example, the patio in level –2 or the Cy Twombly room are far more attractive rooms in which to meet, organize a jazz concert, or hold openings. Dare I predict that within a year of opening, events will flood all over the building? This will affect us as conservators and the objects we care for. I cannot imagine a solution, since incompatible uses remain incompatible. Again, my concerns are just a fear, difficult to quantify, a common situation in preventive conservation.

Behind the scenes, maintenance and accessibility

The air outlets mentioned earlier – the perforated floorboards – raise the question of aesthetics and practicability. On the one hand, there are numerous new museums where excessive emphasis on aesthetics is linked with impracticable designs that affect the daily work of conservators. On the other hand, I am often surprised to see rooms cluttered with fire extinguishers, light panels, telephones, cameras, loudspeakers, loose cables, alarm buttons, and so on. Here, aesthetics and practicability are not correctly balanced. To allow a highly aesthetic design in the Museum Brandhorst, we tried to make functions as invisible as possible, but easily accessible to those who know their location. Thirty-six different functions had to be integrated into every gallery, but few are visible: the perforated floorboards, illuminated emergency escape signs above some doors, tiny light and humidity/temperature sensors by some objects,

concealed touch pads in the door panels, zooming panoramic cameras in the laylights and, if required, additional light sources.

Cleaning and maintenance was another concern; the public sector in Germany, as elsewhere, continues to lose staff. This loss necessitates increased outsourcing. Outsourcing can only save money if the parts of the building to be maintained are easily accessible and the external contactors do not always have to be accompanied by museum staff. All access has to be safely away from the exhibits, but who has not seen electric lamps above objects, windows that can only be cleaned by means of ladders, lifts or mountain climbers, floors around sensitive sculptures that are wet-cleaned with unspecified agents, or the pressure on housekeeping and maintenance staff from long opening hours (and resultant short service periods)? Although not directly within the responsibility of the conservator, all these issues add periodic risks to the objects. Therefore, in the Museum Brandhorst we tried to optimize maintenance and accessibility within the building. For example, above the ceiling is a grid that can be walked on to allow easy maintenance of the louvres, fluorescent lamps to be exchanged and the zooming cameras to be serviced.

The rapidly changing displays in a modern art museum require 'scenery' and the scene-shifters are museum technicians and conservators. Understandably, scene-shifters prefer every room to function in the same way and to be easily accessible, but this has far-reaching design and cost implications. We considered these competing factors and, as a result, while horizontal access had to be limited, vertical access has been expanded. For design reasons, the door format had to be restricted for most rooms and there are only some parts of the museum where oversized doors allow passage of large sculptures, for example the tent by Mario Merz, which is 2.40 m wide when cased. Vertical access is limited by the size of the heavy-load lift to a length of 6 m and a height of 4 m, so we introduced the 'painting slit', the open space in the staircase mentioned earlier. The slit is 12 m long and 95 cm wide and runs from level +2 to level −2. The lift and slit allow most art movements that can be expected, but is our expectation not limited by our vision of the future?

Redefining our position

At the time of printing, it is still unclear whether the Museum Brandhorst will be built exactly as described here. However, this does not affect the principles laid out here. Services, maintenance and accessibility, aesthetics, practicability and conservation needs are all possible areas of conflict. If we want to avoid future difficulties with the building that might affect the works of art, an early involvement of the conservator is indispensable. It is my conviction that everything points to the need for conservators to be involved in museum design. However, wherever you go, you are told that the conservators have not been involved in the planning and decision processes, have not been asked, perhaps not even been informed. But they should be! If you have been in this position, try to remember – did you attend the kick-off meeting, were you invited a second time, did you find that your negotiations always ended in a cul-de-sac? If so, there is often an explanation; in my experience, conservators sometimes start their negotiations from extreme positions that load interpersonal difficulties on to existing technical problems. Consequently, negotiations either take place in a highly tense atmosphere or (more usually) they continue without the conservator; this has to be changed.

Personally, I see the optimization of museum buildings as a core task of preventive conservation. Museum buildings protect or affect the collections they contain as a whole. Every single item in the building is exposed to a permanent risk, but less so in a wisely built container.

In the European Confederation of Conservators–Restorers' Organizations (ECCO) Professional Guidelines from 1993, the aim 'to retard deterioration and prevent damage by creating conditions optimal for the preservation of cultural heritage' is clearly formulated as a core task of preventive conservation. As I see it, museum design is part of this, and as a consequence, it is not the architects, the engineers, or our museum colleagues, but us, as conservators, who have to develop a clear foresight regarding museum design. Any lack of foresight makes any later step a failure, and there are numerous examples built worldwide. Are you prepared?

But do not despair; the most important tool in preventive conservation is common sense! I have been in conservation for 25 years, and I sometimes miss this healthy level of common sense. Another indispensable tool is compromise, even many compromises. Although every compromise may have the aftertaste of a lost battle, preventive conservation is compromise. The conservator's role – our role – will only be accepted if there is a willingness to aim for compromise, but this must be solved in a pragmatic, far-sighted and open way.

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