What will the cultural record say about us?
Stewardship of culture and the mandate for environmental sustainability

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Alfonso Cuarón's 2006 film *Children of Men*, adapted from the P. D. James novel, and set in 2027, presents a world where sudden universal infertility has doomed the human race to extinction. Global social breakdown results, but Britain maintains some semblance of functionality by means of brutal government oppression of its immigrant population. The same government has converted Battersea Power Station into the "Ark of Art," a heavily guarded repository of artistic treasures rescued from collapsing nations and preserved for a "posterity" that is not coming.

At the Ark, dining under Picasso's *Guernica* while society collapses outside, the anti-hero Theo asks the curator, his cousin Nigel, "what keeps you going?" The curator responds "I just don't think about it?"

Today, in the real, not fictional, world, the growing scientific consensus is that climate change is an immediate and universal problem that is caused in part by human activity, notably greenhouse gas emissions. In April of this year, Working Group II of the Intergovernmental Panel on Climate Change released its fourth assessment on "scientific understanding of impacts of climate change on natural**,** managed and human systems, the capacity of these systems to adapt and their vulnerability."

Among the projected climate trends are:
- Virtual certainty of an increase in average temperatures and high temperature excursions
- Very likely increase in frequency of extraordinary rainfall events
- Likely certainty of rising sea levels and coastal flooding

Of course, some have found faults with the measurements, but we do not have to wait to see proof of some of these projected changes, since the leading indicators are already with us.

Consider the National Historic Landmark 1722 Abel and Mary Nicholson House on the Delaware Bay in southern New Jersey. The levees that once protected the arable land are not sufficient to hold back present day tides or storms, and over the past seventy years salt water has encroached further on the site than before the 18th and 19th century levees were built.

The Fourth Assessment Report identifies the potentially adverse implications of these climate change trends for public health, food production, employment and the economy. The various potential impacts of these trends include increased energy demand for cooling, reduced heating demand, stresses on water supplies, flooding, salt water intrusion in coastal areas, displacement

of settlements and interruptions/stresses on existing infrastructure. There is also the prospect of civil and international strife over limited resources which can result in damage to cultural property.

Even more compelling is a 2007 white paper by Global Business Network titled *Impacts of Climate Change, a system vulnerability approach*. The 2007 GBN methodology starts by asking "what are the vulnerabilities of existing, interdependent, social, governmental and economic systems?" It then proceeds to assess how climate change trends and their resultant stressors might act on these vulnerabilities and lead to systemic destabilization or collapse. The potential scenarios are plausible and thought-provoking.

The scientific consensus of the IPCC is that we must reduce greenhouse gas emissions if we are to minimize the human influence on climate change. In the United States, it is estimated that buildings are responsible for up to 48% of greenhouse gas emissions. 76% of all electric power plant output is consumed by buildings in the United States, much of which is generated by coal-fired units, a large emitter of carbon dioxide.

Recognizing this, Architecture 2030, organized by architect Edward Masria, and supported by a number of organizations, including the American Institute of Architects, has launched the 2030 **°C**hallenge, setting ambitious targets for the reduction of energy consumption in the building sector.

What does this mean for us as stewards of cultural property and the cultural record? While our building census is comparatively small, the consumption of energy per square foot of space can be quite high. This is because the management of temperature and relative humidity for collections conservation and archives preservation is conventionally accomplished through the consumption of fossil fuels and electrical energy for air conditioning and dehumidification. Furthermore, the energy consumption of our buildings is directly tied to our expectations and performance requirements for conservation environments.

In the 1970s and 1980s, guided in part by publications such as Gary Thomson's *Museum Environment*, stewards of collections and archives prescriptively tightened their requirements for interior environmental performance, especially with regard to relative humidity.

At the time, comparatively cheap energy and the emergence of sophisticated controls for mechanical systems made close control of temperature and relative humidity for collections environments a practical possibility. In assessing the tightening of relative humidity specifications for museums, J. P. Brown and William Rose noted in 1997 that:

> As mechanical systems increased in sophistication, there arose a general feeling that if ±5%RH was good. then ±3, or even ±2%RH, must inevitably be better; all the more so since the ±5%RH variation was based, as Thomson freely admitted, on the performance of mechanical systems. Any deviation from mid-point humidity became a cause for alarm and again, because little quantitative research on the effects of different levels of humidity variation had been carried out, it was felt sensible to play safe by keeping as exactly to the rules as possible… Also, it was assumed that if close control (±2%RH) provided no more benefit for the objects than wider control (±5%RH), then at least it did no harm; therefore, why not have the tightest level of control that was possible? In fact, we believe that the inward spiral of humidity tolerances proceeded from a fundamental miscommunication between museum staff (conservators, curators) on the one hand, and mechanical engineers on the other.

Coincident with the above were the introduction of low-cost dataloggers and the availability of funding for monitoring and for systems upgrades and replacements. These completed the

equation with a resultant boomlet in replacement of environmental control systems in institutions across the country, a boomlet to which many of us in this room can attest.

However, these "tight" systems were often completed at an unexpectedly high capital cost, with increased operating costs compared to the systems they replaced. Maintenance costs, including steam humidification systems, filter replacements, and software upgrades for controls, surprised many institutions. Many curators and conservators were disappointed when, despite tight specifications, room conditions varied point to point, or that close controlled systems might "hunt' around the target conditions, especially when operating at partial load.

At one house museum, the non-profit steward and their fuel supplier were shocked that their boiler was supposed to run in summer, and that it was essential for dehumidification, a fact that became uncomfortably apparent when they ran out of fuel oil in August during the first summer of operation.

By the mid-1990s, Marion Mecklenberg at the Smithsonian's Conservation Analytical Laboratory reported that there was a direct correlation between sharply increasing energy costs in museums and stringent requirements for temperature and relative humidity control. Recently, David Artigas, in his 2007 Masters thesis at the University of Pennsylvania, confirmed this correlation of high cost and tight control also applied to a sampling of historic house museums.

Given what we have learned, it makes little sense to continue to use the prescriptive design approach and performance requirements for buildings and systems that house collections and archives. As we plan for the next cycle of systems replacements and building expansions, renovations or replacements, we must seek better solutions.

With climate change, collections stewards and architects and engineers will also face design challenges that were not considered two or three decades ago, such as the reduction of greenhouse gas emissions and the adaptive response to climate trends and their implications. Meeting these challenges while providing an interior environment conducive to the longevity of collections and archives is not a trivial problem, nor does it lend itself to recipes, prescriptive solutions or naïve application of scoring systems.

In this symposium we will see a variety of approaches and innovations for achieving sustainable practices for preservation environments, with the prospect of reducing energy consumption and greenhouse gas emissions. Not all of these solutions are applicable to every institution and not all are necessarily compatible with, or complementary to, each other. Successful implementation of these solutions will require interdisciplinary collaboration, and certainly some compromises. It will also require fresh strategic thinking about how to specify, design and operate these environments. To this end, a strategic approach to addressing sustainability and climate change might be based on the following framework:

- Know your stuff.
  Know your collection, its specific materials and their environmental vulnerabilities, past history of exposure and response, and prior conditions against which it has been "proofed" for damage or deterioration.
  Know your climate, and how it might change in the future. Pay careful attention to the transitional seasons of fall and spring rather than the extreme highs and lows of more settled seasons like summer and winter. The transitional seasons are the ones that give buildings and their systems fits.
  Know your building. What is the envelope? How are the internal spaces configured? Does it possess high thermal inertia or moisture buffering? How does it behave hygrothermicly, especially in response to exterior conditions in the absence of the mechanical system?

- Toss the hygrothermograph, or perhaps accession it.
  This 18th century instrument limits our understanding and analysis of the interior environment because of its single, time-dependent, graphical format. Dataloggers are more accurate and reliable, and the available software can better inform stewards and designers in the multi-variant considerations of environmental management. The IPI Climate Notebook goes a long way in this regard, but we should take care to read all the charts, regardless of whether we are engineer, conservator, curator or administrator.

- Avoid target fixation by setting a wide operating window.
  Don't over-specify performance with unnecessarily close tolerances. Specify environmental parameters based on the minimum need for conservation, not the closest possible tolerance for measurement or control. Define environmental performance objectives using statistical methods, such as standard deviation, rather than simple expressions of allowable range. Determine where the critical measurement is to be taken beforehand. Always recognize that the conditions at the object level, particularly in storage or archives, are likely to be more stable than those in the open room.

- Anticipate the future exterior environment.
  Engineers and building codes base design of mechanical systems on published historical climate data. However, we are designing buildings that should have a life expectancy of at least 100 years and mechanical systems that should have a functional service life on the order of 25 years. Based on present trends, the exterior environment is undergoing change, not only with respect to temperature extrema, but perhaps more importantly for the collections, with respect to moisture intensity and variation frequency. These changes may be critical over the service life of the building and its systems, but there is a practical limit to predictability. Therefore, the building and systems design should provide for future adaptability or improvement to address the potential for new exterior conditions or new energy conservation technologies.

- Think of cascade gradients as Russian nesting dolls.
  It is easier to maintain large differences in temperature and moisture if we cascade the gradients across multiple spaces and enclosures. On a large scale, architecturally separating collections areas from the exterior with buffer spaces or corridors is highly effective. At the object level, we can extend this effectiveness by cascading the gradient through the storage furniture, exhibit casework and object housing.

- Provide inherent, passive, hygrothermic stability, from the building envelope to the housings.
  Use building materials with high thermal inertia and moisture buffering capacity to provide inherent temperature and relative humidity stability. At the object level, select housing and packing materials that provide moisture buffering from variations in room relative humidity. Tim Padfield of Denmark has been a consistent advocate of this common sense approach.

- Think like an environmental accountant.
  Consider the total life cycle analysis of building and systems.

- Design for the downside risk by requiring robust, survivable systems.
  Consider the downside risk scenarios for operations, such as interrupted energy infrastructure, escalating energy costs or sudden fiscal constraints. Design simple systems with ample space for repair and maintenance so that they can be operated to provide a minimum threshold environment in the event of an emergency, or its protracted aftermath. One of the lessons learned from New Orleans was the extended interruption of personnel and services after the passing of the storm. Even under normal conditions, it is preferable to have +/- 10% RH control without a service technician than to have +-5%RH control that is staff or technician intensive.

- Build a collaborative team.
  As we can see, the strategic approach crosses disciplinary boundaries and responsibilities of the institution, its consultants and contractors. For success, all of the institutional departments – such as facilities, conservation and curatorial, education and interpretation, and finance, as well as design and construction organizations – should have active and engaged representation throughout the planning, design, construction and commissioning process. The process does not stop when the collections are moved in, but should continue as new systems are proven and results are monitored.

Even as we successfully implement sustainable practices for the preservation of our collections and archives, we cannot be content that we have fulfilled our responsibilities with regard to the human influence on climate change. As stewards of culture, we also have a responsibility to inform the public. Environmental sustainability and climate change are considered by many to the most pressing universal issue of our time and warrant greater public exposure and education here in the United States. The fundamental challenge in this regard is the lack of an overarching national public policy. Fortunately, individual states, and many corporations, including WalMart, are seizing the initiative to promulgate their own policies.

As stewards of the cultural record and heritage, we are in a unique position: we have a highly developed ethic of stewardship, we have a perspective of the long view toward the past and the future, and we have the public's respect for our institutions as sources of unbiased information. In such a position, we should take a leadership role in implementing environmentally sustainable practices. We can also demonstrate to the public the importance of stewardship in the broad sense, inside and outside the building, even when the implications seem to be in the distant future. By promoting a culture of stewardship toward the environment in this period of critical global need, we can be certain that the record will also reflect well on our stewardship of culture. Later, when asked what happened, none of us will have to answer "I just didn't think about it," or "I left it up to WalMart."

Thank you.