

SUSTAINABLE EXHIBIT DESIGN

**Guidelines for designers of small scale
interactive and travelling exhibits**

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edited by Geoff Matthews

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We recognise that this report barely scratches the surface of a complex and growing subject. Any errors and omissions are of course entirely the responsibility of the author and editor. We invite and welcome constructive criticism, corrections, additional information, and further useful references and contact details. We plan to update and expand the publication from time to time and all contributions used will be acknowledged in subsequent editions.

Preface

Background to the project

FLOWS is an EU-funded Project aimed at learning to live with flood risk in a changing climate and involves partners from the UK, Netherlands, Norway, Germany and Sweden. The UK partnership consists of Cambridgeshire, Lincolnshire, Norfolk, Suffolk and Northamptonshire County Councils and the Environment Agency.

This study was commissioned as part of Lincolnshire County Council's FLOWS '2B' Information and Symbols Project and UK match funding for this particular FLOWS Project has been provided by East Midlands Development Agency.

The aim of FLOWS is to improve the sustainability of development in flood risk areas through development of 'good practice', by improved integration of flood risk information into decision-support systems for spatial planning and water management. We aim to achieve this overall all project aim by addressing the following objectives:

- 1. Delivering strategic, practical, innovative projects that provide additionality to existing initiatives and programmes in spatial planning and water management in the partner countries.**
- 2. Developing on-the-ground projects to demonstrate and test techniques that protect land and property and/or make property more resilient to flooding.**
- 3. Designing projects with widespread application and transferability within and among the four partner countries and within other EU/EEA nations, focussing on testing principles for application in different geographic locations.**
- 4. Maximising the opportunities for sharing knowledge and expertise among the partner countries to solve common problems efficiently and cost-effectively.**
- 5. Implementing a robust and innovative programme for disseminating FLOWS products for application in other EU/EEA nations and the partner countries.**

Lincolnshire County Council's *FLOWS 2B Information and Symbols Project*

FLOWS involves over 40 individual projects which are based in four Work Packages. Lincolnshire County Council is jointly leading Work Package 3 (Spatial Planning) and is also leading on Projects in Work Package 2 (Public Perception/Dissemination).

This study has been produced as part of Lincolnshire County Council's 'FLOWS 2B Information and Symbols Project' and in the wider context, is focussing on raising public awareness of flooding and flood risk by exploring innovative methods of disseminating information on the subject of flood risk to the public. This project involves the production of interactive exhibits aimed at raising the awareness of flood risk in Lincolnshire and is a partnership between Lincolnshire County Council and the School of Architecture at the University of Lincoln. A study focussing on creating sustainable exhibitions has been undertaken via the University of Lincoln that will directly inform the FLOWs exhibits.

As detailed in the project brief, this study on Sustainable Exhibit Design will investigate best practice in sustainable exhibit design and produce a report setting out guidelines for designers of small interactive and travelling exhibits, guidelines which are directly applicable to the proposed FLOWs exhibit. The report will form a contribution to exhibition design knowledge through wider distribution via the University of Lincoln and FLOWs websites and a conference presentation.

1.0 What is sustainable design?

1.1 Overview

The United Nations set up the World Commission on Environment and Development (Bruntland Commission) in 1983. In 1987 it published *Our Common Future*, which defined sustainable development as 'meeting the needs of the present without compromising the ability of future generations to meet their own needs' (MacKenzie, 1991, 10).

Design's role in achieving sustainability is defined by the Design Council as, '...delivering the best (social, environmental, economic) performance for the least (social, environmental, economic) cost.'

For a designer to achieve sustainability in their work a holistic approach must be adopted, one that addresses the spectrum of needs indicated by the three pillars of sustainable development: social responsibility, environmental protection and economic development. Therefore, in the process of resolving the design concept, its aesthetic appeal and its functionality, the exhibition designer adopting sustainable principles must take into account the impact an exhibition has during construction, use and disposal. To do this the designer needs an understanding of the sustainability issues which are discussed later in this report.

1.2 Political background

The detrimental effects of industrialised manufacturing processes on social relations and the environment were recognised as early as the 1850s in the works of John Ruskin, and have received varying degrees of acknowledgement ever since. For example, the Arts and Crafts movement at the end of the 19th Century and the Bauhaus in the early 20th, each in their own ways reflected contemporary concerns about economic use of materials and maintenance of human dignity, and an idealistic belief in the potential of design to improve the environment.

Sustainable design is an aspect of sustainable development, an idea which was formalised at the 1972 UN Conference on Human Environment in Stockholm. For the first time nations met to consider global environment and development on the same agenda.

The Bruntland Commission's widely accepted definition of sustainable development informed much of the subsequent debate. Margaret Thatcher's speech to the UN in 1989 regarding the damaging and dangerous ways in which humankind and its activities were changing the environment of our planet could be considered a landmark reference to environmental concerns. She stated that '...we shall only succeed in dealing with the problems through a vast international, co-

operative effort' and that 'countries who are industrialised must contribute more to help those who are not' (Monbiot, 2005).

'The momentum lasted until just after the Rio Earth Summit in 1992' (ibid.). Twenty years after Stockholm, it was instrumental in highlighting man's consumption of the earth's natural resources and the impact their depletion was having on the natural bio-diversity of the planet. It also drew attention to increased levels of pollution in the atmosphere, earth and oceans. The conference set out policies on sustainable development including the Convention on Biodiversity and the Framework on Climate Change (UNFCCC).

In February 2005 the Kyoto Protocol, a set of policies aimed at the reduction of greenhouse gas emissions, came into effect. The Intergovernmental Panel on Climate Change predicted that, even with successful implementation of the Kyoto Protocol, greenhouse gas emissions will continue to rise for many years and a balance will not be restored before 2100 (——— 2001).

Changes, drafted in 2004, to parts F and L (ventilation and fuel conservation) of the Building Regulations will come into effect in 2006. These are intended to help the UK meet its carbon emission targets and primarily affect buildings. Many standard practices, originally applied in the design and construction of buildings, have already been adopted in smaller scale construction. It may only be a matter of time before the resource-efficiency of exhibitions is regulated by law.

1.3 Consumer issues

Since the early 1970s the work of organisations such as Greenpeace and Friends of the Earth has increased public awareness of environmental issues. This has created increased demand for green products, and environmentally aware consumers are now recognised as a considerable market force.

Designers, in a sense, lead double lives: they are both consumers and suppliers. They experience goods and services at both ends of the supply chain. Designers may have to judge the environmental claims made for products in the board room and on the high street. By having one foot in the 'real world' and one in the business of 'changing it for the better' the designer is in a position to develop an informed perspective on the adoption and implementation of sustainable design practices. All that is needed is the will.

Users of buildings are aware of problems such as Sick Building Syndrome and the toxicity of materials used in their construction. Consequently public expectations of the health and safety of their environments are increasing, just as they are of other products, food and services.

1.4 Economic benefits

Consumer products are very often designed, produced, bought and used in very different locations around the globe. This means that the environmental consequences of consumer culture are very unevenly distributed. In his revolutionary book *Small is Beautiful: Economics as if People Mattered* (1973) Schumacher highlighted how western economic systems could impoverish workforces in developing countries and damage the global environment. Measuring 'true cost', he proposed, meant accounting for environmental impact as well as economic benefit.

If the global environmental and human benefits are in some ways still immeasurable, the financial performance of companies is not. The benefits to a company of employing a sustainable design policy can be measured in financial terms. Reduced energy and material costs and increased wellbeing and productivity of staff, for example, are measurable potential gains.

Commercial organisations are constantly striving to distinguish themselves from their competitors. Stating one's environmental credentials is a recognised but still little-used marketing tool. There may be a public relations benefit as well as an improvement in sales if environmental policy results in recognition such as the Green Mark Award (see below 5.2.4). There are also benefits for society as a whole because designing for sustainability improves the environment and quality of life for all.

1.5 Environmental issues

Guidelines for sustainable exhibition design can only be established in the context of an understanding of the impact of the industry and its supply chain on the environment. Designers, therefore, need to be aware of the broader environmental issues.

In 1995 the European Environment Agency defined the key environmental issues of the day as: climate change, ozone depletion, acidification of soils and surface water, air pollution and quality, waste management, urban issues, inland water resources, coastal zones and marine waters, soil quality and biodiversity. (Fuad-Luke, 2002, 12)

The most pertinent issues relating to sustainable design are outlined below. It should be noted that these issues can be interconnected.

1.5.1 Global Warming

An increase in some of the gases that occur naturally in the earth's atmosphere has been caused by industrialisation. As a result more heat is trapped in the atmosphere. The main cause is the large amount of

carbon dioxide (CO²) released when we burn wood, oil and coal (fossil fuels) for energy production. The net result could be a rise in the annual global temperature with subsequent effects on ecosystems including rising sea levels. To prevent global warming, emissions of CO² must be reduced by using alternatives to fossil fuels. Overall energy use, especially when that energy is derived from fossil fuels, must also be reduced through increased efficiency in industry and use of low energy products.

1.5.2 Ozone Layer Depletion

Ozone provides a protective layer against higher-energy ultra violet radiation from the sun. Depletion of this barrier means more of these harmful rays reach the earth, causing damage to all living things. It may also lead to changes in climate and the ecosystem as a whole. The release of chlorine when chlorofluorocarbons (CFCs) are broken down in the atmosphere is largely responsible for the depletion of the ozone layer. Alternatives to the use of CFCs must be found.

1.5.3 Tropical Deforestation

The destruction of forests can be driven by the need for local agricultural development but sourcing timber for the construction industry is also a major factor. The effects are: destruction of species, desertification, loss of indigenous people's habitat, and climate change. During photosynthesis trees absorb carbon dioxide from the atmosphere, so as huge areas of forest are being destroyed the consequences are disruption of local climate patterns and global warming.

1.5.4 Waste

Most waste is deposited in landfill sites, some is incinerated and some dumped at sea. All of these methods have serious repercussions: toxic chemicals leak into the soil and water supply and greenhouse gases escape into the atmosphere. Rubbish in landfill does not biodegrade because the environmental conditions are not conducive. And dumping, rather than reusing and recycling, waste is a drain on non-renewable resources (see below 3.1 Minimising Resource Consumption).

1.5.5 Water Pollution

The demand for water by the general population and industry has increased so dramatically that there is a shortfall in the amount of clean water available to meet requirements. This is exacerbated by the pollution of water sources by toxins, sewage and industrial effluent discharged into watercourses. As well as reducing the amount of water available for drinking, the presence of harmful substances in water systems causes damage to aquatic habitats for flora and fauna.

1.5.6 Resource Depletion

Consumption and potential exhaustion of non-renewable natural resources have an effect on the ecology of the planet. The full extent of this effect may not be known until long-term research has been carried out but the depletion of these resources may have serious implications for future generations and their ability to meet even their basic needs.

2.0 Research methods

2.1 Methodology

This study is a preliminary survey of guidelines and sources designed to provide a foundation for further and more detailed study. It does not seek to develop a new theory of sustainable exhibit design or to test any specific hypothesis. If it helps subsequent researchers by identifying some of the gaps and weaknesses in our knowledge it will have fulfilled a useful purpose.

However, the study also has a pragmatic objective: to inform and stimulate further enquiry through creative design practice.

The methodology, therefore, is also characterised primarily by its call to pragmatism. Meanings in the discourse of sustainable design are hotly contested and evolving. It is particularly important therefore that there is a continuing dialogue and the opportunity for the hard-won knowledge of practice to feedback into the development of a useful body of knowledge, in the spirit of Rorty (1989), one that represents the best that we can do for the time being.

Users of the report are asked to make critical comment on the guidance it offers and to submit additional information for inclusion in the database and bibliography. The report is a working document and will be periodically reviewed and updated in the light of responses received and ongoing research in the field.

2.2 Sources

The resources used in the study include those that are free of charge and readily accessible to students and the public. The starting point for research was the internet; all books, journals and periodicals used were available in public and academic libraries; and a number of design professionals were selected for interview on the basis of completed design projects that embodied aspects of sustainable design. Further resources were identified but, because they are available only by subscription, they were not used: references to some of these are included in Appendix 1.

2.3 Identifying the scope for research

While sustainability covers issues relating to social, ethical and economic considerations this report concentrates mainly on the direct and indirect environmental implications of designers' practices.

The timing of the research effort coincided with a live project for students on the Museum and Exhibition Design degree course at University of Lincoln, UK. They were asked to design a small-scale interactive exhibit which aimed to raise public awareness of flood issues – a topic of immediate environmental significance.

This study, therefore, was initiated to increase the student exhibition designers' knowledge of the relationship between the design decisions they make and their environmental consequences. The technical specification of exhibits can have a positive effect in minimising detrimental environmental impact. This is a relevant consideration regardless of the subject matter to be communicated by the exhibit.

Generally, the research aimed to highlight issues that should be considered and offer guidance to designers so that they can ask the right questions and make informed decisions.

Though the function of exhibits may be quite specific to their design, manufacture uses process and materials that are common to other industries. Solutions are often bespoke and can only be achieved by employing technologies and components adopted from outside of the commonly accepted norm. It could be said, therefore, that any and all sustainable technologies, no matter what their current application, may have relevance to exhibit design.

Exhibit design can be seen as a specialism but in this context is best understood as a multi-disciplinary process. It brings together elements of other design and manufacturing practices including: furniture, products, audio-visual, graphics, lighting, and mechanical and digital interactivity. As such, the experience of related disciplines and professional may have relevance and give insight.

2.4 Precedents and examples

Initial research showed that existing information on sustainable practice in exhibition design is scarce, implying that the area is relatively unexplored. Though example projects can be found, an analysis of their sustainability could not. In order to source relevant information it has been necessary to look to the wider design industry.

Example projects are referred to in the report to help illustrate applications of sustainable design strategies. Some could be adopted by exhibition designers. In cases where the application is not straightforwardly transferable to exhibition design they may nevertheless help to stimulate further research.

2.5 Classification systems

One outcome of the research has been to identify specific products and

materials that could be employed by designers. References to these are included in Appendix 1. Where existing sources have classified materials, some do so according to their physical properties or applications and others according to their environmental benefits.

At the time of writing, The Building Centre, an industry sponsored library and product information centre is planning a section specifically to promote 'green' products, as they refer to them. Generally, the Building Centre along with the RIBA (Royal Institute of British Architects) Library and many suppliers worldwide use the CI/SFB library classification system.¹ Codes for products and materials are shown on literature so that they can be searched according to category. For example, No.77 Special Fittings, is the section that includes specialist exhibition fit-out products.

The CI/SFB system does not classify separately those products which make sustainability claims. The Building Centre's Information Manager is aware of the growing demand for information about green or sustainable products and materials. Consequently, in addition to its new Green Zone, the Centre does have a separate library section for suitable products which uses its own unique classification system.

Even if industry libraries used a common system for classifying sustainable products and materials it is unthinkable that they would verify the environmental credentials or claims made by suppliers. In the absence of a worldwide system of accreditation designers and specifiers will need to carry out their own research to inform their choices.

2.6 Interviews

2.6.1 Selection of Subjects

Interviewees were chosen who, according to preliminary research, had demonstrated knowledge of environmental issues or had employed sustainable design methods in practice. Notes on some of the interviewees, their organisations and relevance follow.

The Centre for Alternative Technology is an education and display centre that uses renewable energy and environmental buildings.

Land Design Studio, a museum and exhibition design company, demonstrated a use of sustainable design strategies and has won environmental awards for its designs.

¹ CI/SfB stands for Construction Index/*Samarbetskommitten for Byggnadsfrågor*, a Scandinavian system of classification originally set up in 1959 and specially designed for the construction industry.

The architects Hawkins and Brown were interviewed because of their work on the Roald Dahl Centre which employed some sustainable principles. The interview provided useful background knowledge for this report.

Interviewees were asked the same principal questions and then more specific questions relating to their field of expertise and project experience. Transcripts of the CAT and Land Design Studio interviews, from which more detailed information and ideas were drawn, appear in Appendix 2.

2.6.2 Evaluation

Interviewees' responses were evaluated and condensed and are referred to throughout the report. Extracts of the information have been interpreted to form the basis of some of the principle guidelines of this report.

3.0 Principles of sustainable design

In the simplest terms sustainable design should adhere to two main principles:

1. Minimising resource consumption
2. Reducing pollution.

In section 4, Sustainable Strategies, all suggestions relate back to one or both of these main principles.

3.1 Minimising resource consumption

Resources or raw materials can be classified as 'renewable' and 'non-renewable'. Increasing the use of renewable resources over non-renewable ones is imperative. But even more important is the reduction in consumption as a whole. The mantra 'reduce, reuse, recycle' should be at the forefront of design and manufacturing policy. Each of these three tenets is adopted repeatedly in the sustainable practices listed in Section 4.

In this analysis it is necessary to consider energy as a resource. It may be a sustainable one if derived from biomass, solar, wind or wave generation or an unsustainable one if derived from non-renewable fossil fuels such as coal, oil or gas.

Specifying renewable raw materials, and products derived from them, is a strategy designers should employ to significantly reduce resource consumption. Occasionally a non-renewable product or material will have to be used where no suitable substitute is available. To make the right decisions in this area, the ability to identify which materials are in shortest supply, is essential. There are varying estimates of the reserves of different materials and as a guide there is a useful table in Berge (2001, 20).

3.2 Reducing pollution

Pollution is the major contributor to global warming, ozone depletion and destruction of habitats. The irresponsible use of resources which cause pollution has an impact on all life on the planet.

To achieve sustainability the production of pollutants must be reduced in energy generation and use, manufacturing and service industries, and waste management.

Pollutants and toxins exist in many materials where their effect may be unknown or unquantifiable. The problem with toxins is that many will end up in landfill at some point and they cannot be contained. Contaminants such as heavy metals, toxic chemicals and concentrated

nitrates eventually find their way into the soil, rivers and water supply thus damaging ecosystems, wildlife and plants.

An example of a material often used in the building trade, which has a high level of toxins is Polyvinyl chloride (PVC). During manufacture and combustion high levels of dioxins and organochlorines are released and these are known to be linked with cancer, immune system damage and hormone disruption.

Designers may not have an opportunity to change the composition of what they specify, but usually they do have the chance to specify alternatives which are less harmful.

4.0 Sustainable strategies

4.1 Consumer desire

In a consumer society design is used in many ways including as a communications tool, as in exhibit design. A common communication technique is to appeal to visually literate and sophisticated audiences through the use of fashionable finishes and materials. Designers, of course, establish fashions as well as exploit them.

Design's role in creating consumer desire cannot be ignored and since this process demands continuous change, designers are faced with a challenge. Their work may need to be sustainable and capable of renewal through evolution, redevelopment or replacement. Ensuring that renewal is sustainable requires careful and creative design consideration.

Designers can also help to nurture the desire on the part of clients and consumers for sustainable solutions, whether these are systems, environments, consumer goods, communications or products that combine these such as exhibits. One of the challenges of sustainable design is to make it appealing to the client and general public.

'Designers have participated in the disposable society, creating new styles with increasing frequency, and therefore building in obsolescence,' (Mackenzie, 1991, 11). Designers now need to take responsibility by designing to extend the life of a product. This may be achieved by developing more robust technical solutions and by taking account of the longevity of a design's aesthetic appeal.

A common misperception is that environmentally sound products sacrifice something in terms of performance. The Centre for Alternative Technology has found that there is still 'quite a lot of resistance amongst the general public that these things [sustainable designs] can look modern and be part of the mainstream without compromising performance and aesthetics,' (Carrie Bradshaw, Appendix 2). A designer employing sustainable design practices has to challenge this assumption with imaginative designs for products that are just as viable as the non-sustainable alternative. Adhering to this principle ensures that sustainable designs are desirable.

By encouraging debate and questioning existing products and approaches, sustainability in design can be brought to client's and the public's attention and successfully promoted on its merits.

4.2 Cradle-to-grave analysis

4.2.1 The environmental 'footprint' of a product is judged on the detrimental effect it has on the environment during its production, use and disposal.

This is called the 'cradle-to-grave' effect and is something that can be taken into account by designers wishing to adopt sustainable practices at all stages of the design process and in every aspect of exhibition design. This includes the materials they specify; where they will be obtained and how they are manufactured; how an exhibition is constructed; how it will be used and disposed of; and the type of energy used in the exhibition. The list could be extended but what is important to remember is that adopting good practice at any stage, even if not all stages, can still yield a positive return. The key is that the designers question decisions with an environmental agenda in mind and that they know the right questions to ask. The cradle to grave approach requires step-by-step analysis and a response that makes its use more accessible.

- 4.2.2 The exhibition designers at The Centre for Alternative Technology used the cradle-to-grave approach in deciding which materials were best employed in the construction of weatherproof shelters in their project 'Bringing the Future Forward'. PVC, hemp and glass were all considered.

Whilst the performance of PVC met the design criteria, the processes involved in its production and the fact that it is not biodegradable meant that it failed to meet sustainable design criteria. Hemp is a renewable resource and biodegradable, but it would quickly deteriorate unless impregnated with chemicals and replaced on a regular basis. In this instance its application would be inappropriate and would give the impression that sustainable living necessarily involves high maintenance.

In the end it was decided that glass best met sustainability criteria. It could be manufactured from recycled glass, could be recycled when disposed of and met the weatherproof and durability performance criteria.

- 4.2.3 For the design of travelling exhibits an audit of the original client brief from a cradle-to-grave perspective may well be valuable. The client and designer may originally emphasise their interests in the exhibit's appearance and performance at host venues but not take into account what happens between venues. The design team, therefore, should ask what transport is needed. What resources are needed to assemble and disassemble the exhibit? What space and conditions are required to store the exhibit? Will the exhibit be disposed of after a set period of use or will it be adapted for reuse?

- 4.2.3 Embodied energy

One measure to be considered in design for sustainability is 'embodied energy'. Every material has a value of *embodied energy*, which equates to the amount of energy used in its production. For example it takes 100 times more energy to produce a tonne of aluminium than it does a tonne of sawn timber. Aluminium, therefore, is considered to have a

relatively high value of embodied energy. 'Materials extracted directly from nature and requiring little processing tend to be low embodied energy materials' (Fuad-Luke, 2002, 282). These are the materials that should be used in sustainable practice.²

4.3 Dematerialisation

4.3.1 According to Geiser (2001) the global energy economy can be seen as 'open' and the global materials economy, by contrast, is 'closed'. That is, the planet receives energy from the sun and cosmic sources and loses energy into space, so it appears to us to be created as well as consumed. Whereas, other than in meteors and cosmic dust, material is never added to the planet, it is simply continuously transformed and, therefore, appears to us to be consumed as it changes from useful forms into useless ones. For this reason alone material resources should be used carefully in ways that keep them circulating usefully and for as long as possible in the global materials economy.

4.3.2 Dematerialisation means 'to use fewer material resources'. Given that all materials have an embodied energy value and many are non-renewable, dematerialisation is an important strategy. It can be achieved by designing products to be simpler, lighter or just smaller whilst still meeting the requirements of the design brief.

Simplification could mean a less ornate design or one that uses a smaller, more carefully considered palette of materials. This approach could make materials easier to source, construction and disassembly less energy intensive, and disposal lower in environmental impact.

4.3.3 However, simplification of designs can have disadvantages. Off-cuts from the manufacture of lighter-weight components can result in hidden waste. Also, smaller objects can make the retrieval of component parts more difficult.

4.3.4 It could also be argued that a travelling exhibit designed to serve dual or even multiple functions, achieves dematerialisation by using the same materials to achieve several ends. This approach is likely to appeal to clients on an entirely financial level. For example, a designer could suggest a partnership or consortium of clients with complementary aims who share a potential audience or geographical marketplace

4.3.5 The use of plywood and composite boards rather than solid timber is an example of dematerialisation. This is because the recycled wood waste used in their manufacture reduces the proportion of virgin timber required. Specifying manufactured boards without veneers, coatings or other decorative finishes can further reduce material consumption.

² For a list of embodied energy values of a range of common materials see: Fuad-Luke, 2002, 283.

However, advantages gained in the reduction of material consumption have to be weighed against the likely increase in energy used to produce composite boards and the potential health hazards associated with the use of glues and resins.

- 4.3.6 The practice of dematerialisation has been successfully adopted by British Telecom (BT) in the re-design of the telephone directory. Working with designers Colin Banks and John Miles they developed a new highly-legible typeface which allowed a reduction in type size and letter spacing, and an improvement in readability. Page layout was also more economic and the result was a 10% saving of paper on a print run of 24 million directories each year. There were also savings in the ink used and in transportation costs.
- 4.3.7 Taken to its natural conclusion, the process of dematerialisation may ultimately involve replacing some types of exhibit with other forms of communication. Designers of exhibits are unlikely to do themselves out of a job by advising clients that communication via a web-site, direct mail or telemarketing campaign would be more cost effective or environmentally benign, but it may well be the case. What this conflict of interests does highlight is the importance of utilising any communications medium effectively and ensuring that best value is provided.

For example, a travelling exhibit that fails to exploit the potential of the exhibition medium or which merely emulates another communications medium that uses fewer resources is certainly wasteful but also could be seen as failing in communication terms: environmental responsibility is increasingly part of the message.

4.4 Energy use

- 4.4.1 There are two aspects of energy use the designer has to consider: first, how the energy to be consumed is produced (i.e. from a renewable or non-renewable source); and second, how the consumption of this energy during every stage of an exhibition can be reduced. '...the designer who fails to implement energy-conserving measures will be placing "waste" carbon dioxide into the atmosphere without regard to the consequences' (Vale & Vale, 1996, 56) by consuming excess fossil fuels in energy production. Utilising renewable energy is a practice that does not deplete fossil fuels and produces less pollution in its generation.
- 4.4.2 Energy use has to be considered in the manufacture of the exhibition as well as during its operation. Energy is consumed in the extraction and conversion of raw materials used in exhibition construction. It is used in transporting materials between suppliers and manufacturers and in delivering finished exhibits. During operation and maintenance the inclusion of lighting, electrical appliances, compressed air, and powered interactive elements all have energy use implications.

- 4.4.3 When looking for ways to reduce energy consumption in the 'Earth Today and Tomorrow' galleries at The Natural History Museum, Land Design Studio noted the potential of the bank of windows that run down one side of the exhibition space. The large graphics were designed to be printed onto transparencies and clipped to the windows. In this way daylight is used to backlight the graphics rather than a light-box powered by electricity.
- 4.4.4 The designer should investigate what provision for lighting, heating, ventilation and power supply exist in the likely venues for a travelling exhibition so that doubling up can be avoided. If an exhibit requires its own power supply to operate on a remote site, for example, a small self-contained renewable source may be suitable. Solar power packs for laptops and small wind turbines for yachts already exist. Although no examples of the application of this technology to travelling exhibits could be found, the Architecture Centre in Kingston upon Hull, designed by Niall McLaughlin Architects and to open in 2006, is an example of a relocatable carbon-neutral exhibition building that uses these and other technologies to minimise energy consumption.
- 4.4.5 If artificial lighting is required, specifying low-energy lamps can reduce electricity consumption. However, in temporary and travelling exhibitions it is important to rescue and reuse long-life lamps to ensure that the greater capital cost to the client is recouped in the longer term. Compact fluorescent lamps use a fifth of the energy of the tungsten filament equivalents and last up to six times longer.

As light sources, light emitting diodes (LEDs) require very little power, have low maintenance costs but relatively low light output based on current technology. The challenge for designers is in creating the most appropriate lighting for particular purposes and each type of project whilst resisting the temptation to over-specify. Although in museums light levels are strictly limited to the lowest comfortable levels to protect sensitive collection material, in commercial exhibitions there is a tendency to literally try to outshine the competition.

4.5 Transport

- 4.5.1 The unnecessary use of transport places excessive demands on fossil fuel resources. The burning of petrol and diesel also increases carbon emissions and other toxic pollutants. 'The manufacture and transportation of building materials consumes 10% of the UK's total energy consumption,' (Appendix 1).
- 4.5.2 The Centre for Alternative Technology is a static site but is noteworthy because it encourages visitors to use public transport by offering a discount on the admission fee. As well as hoping to achieve a reduction in the use of inefficient forms of transport there is another side to this policy: it reinforces the Centre's message concerning environmentally

sound practices, and helps create public commitment to sustainable principles.

- 4.5.3 Contractors can reduce transport use by employing locally produced materials and services wherever possible. This practice also enhances social and economic sustainability.
- 4.5.4 Transport considerations can also be crucial to good sustainable design decisions. For example, specifying a material that meets a wide range of sustainability criteria but has to be transported from the other side of the world may be worse than choosing a non-renewable alternative with higher environmental impact but sourced locally.
- 4.5.5 If a touring exhibition is dematerialised, transport needs during its operation may be significantly reduced; the smaller or lighter the freight the less fuel energy will be required to move it. For example, a touring exhibition that packs into a bicycle trailer might be an appropriate solution for a series of local venues.
- 4.5.6 Logistics

A travelling exhibit attracts its audience by moving to accessible locations, so transportation during its life is unavoidable. However, there would be little point in an exhibit, however green its design, criss-crossing the country to locations members of the public can only reach if they make special trips. Designers may advise clients when planning a transport and maintenance programme to consider how to minimise total travelling distances for the exhibit and the visiting public.

Geographic intelligence such as postcode-based analysis offered by the Ordnance Survey's 'Code Point' software and map-based studies of proximity demographics offered by the company Mapinfo may help to increase the effectiveness of an exhibit by determining in advance the size and consumer profile of its potential audience. Maximising the audience of each site for a travelling exhibition makes commercial and environmental sense.

The UK's Department of Transport funds the Energy Saving Trust which offers advice on energy consumption issues for everything from light bulb specification to developing transport plans for commercial vehicle fleets. Choosing the most energy efficient vehicle to transport an exhibit, knowing the most fuel efficient way to tour the country and knowing where get green fuels are all aspects of an overall logistics plan that may benefit a travelling exhibition's programme.

4.6 Design for disassembly

- 4.6.1 Products can be designed so that their individual components are easily retrieved at the end of their life; this can be instrumental in facilitating recycling and reuse of materials. Designing for the reuse of materials is one way of reducing the amount of material destined for landfill.

In exhibition design waste can be greatly reduced if an exhibition is designed for disassembly. To do so successfully designers must consider disassembly from the conception stage. They should determine who will be responsible for dismantling the exhibit and separating it into its component parts. To make disassembly a realistic proposition they may also need to 'design out' the need for specialist tools and knowledge.

There are many exhibition systems on the market from simple folding mechanisms to complex post, rail and panel kits that can be used to produce an infinite variety of structures. Most are designed for adaptability, ease of maintenance and storage, and reduced operational costs, all factors which contribute to sustainability. However, designers and clients may consider that their appearance compromises the delivery of a strong message and their extreme flexibility a more thoroughgoing address of sustainability issues. In the end an exhibit designed to reflect an organisation's identity and ethos using fewer, larger, more easily packed components may offer better results.

4.7 Waste management

4.7.1 According to the Environment Agency, the construction industry, which includes demolition, is currently responsible for 19% of the UK's total waste output. In 2002 the Sustainable Exhibition Industry project (SEXI) analyzed the commercial exhibitions industry's contribution to this total by surveying attitudes and practices in waste management. One of the most surprising discoveries was that the majority of waste was not produced at the end of a temporary show but during the construction phase. This clearly points towards poor current practice (Appendix 1).

4.7.2 Reducing waste

The first practice to adopt in waste management is to reduce the amount of material to be disposed of. Employing the practices of dematerialisation and designing for disassembly to facilitate reuse and recycling is a means of achieving this.

4.7.3 Reducing waste pollution

Reducing the waste generated also minimises the pollutants released into the environment from landfill sites, incineration and dumping at sea.

Another aspect of achieving good waste management is to specify materials that are inert or biodegradable. For example, paints and varnishes that are water-based or derived from plant-based solvents biodegrade on disposal. They also release fewer toxins during manufacture, use and disposal, which results in less hazardous waste.

Biodegradable paints and finishes also fulfil the other sustainable principle of reducing resource consumption as organic paints mainly contain materials from renewable resources.

If it is not possible to specify a material that fits sustainable criteria for waste management the next best option is to know which materials to avoid. Paints containing synthetic solvents, fillers and additives should be avoided as they are derived from petrochemicals and contain toxins. PVC will not biodegrade in a landfill site but will release dioxins, phthalates and heavy metals into the soil and water sources.

4.7.4 Waste recycling

After the 'planned' life of a product is over some of its constituent parts or materials can be recycled and a strategy for waste disposal can facilitate this (see 4.6 Design for Disassembly). For example, carpet is a major waste product of commercial exhibitions. In 2002 the UK market for second-hand carpet was saturated, which meant that a large proportion of waste carpet went for land fill or incineration. In 2004 Interface Inc. the world's largest carpet manufacturer announced that it had 'developed a new material for carpet making called "solenium" claimed to last 4 times as long as traditional carpets, use 40% less raw material and to be entirely remanufactured into new carpets' (Worldwatch Institute, 2004).

4.7.5 Office waste from design practices and their contractors should not be excluded from a waste management plan. Paper and ink cartridge collection and recycling are now widespread but this practice could be extended to include other materials and equipment.

4.7.6 Calverts, a London based Design and Print Cooperative, uses vegetable oil based inks as opposed to those containing volatile organic compounds. Its waste ink is removed by licensed carriers who use bio-digestion to break down the ink into a non-hazardous liquid and all the used ink tins, printing plates and plastics are collected for recycling.

4.7.7 In the Netherlands, demolition contractors must state how much of the material will be sold for recycling at the tender stage of a project. The types of materials in the construction of an exhibition need to be carefully specified, as some materials are not compatible with recycling or reuse. Markets for secondhand materials need to be established.

4.8 Specifying materials

4.8.1 Simply listing sustainable materials that the designer can select from has a quick-fix appeal. However, sustainability is often a relative measure and context is everything. Some materials suppliers are listed in Appendix 1, but the designer needs to assess the merits of any selected material by considering its suitability against many criteria, some of which will be project specific. Common criteria include:

aesthetic appeal, availability, cost and performance. In addition, sustainability criteria include: renewability, embodied energy, recyclability, true cost, resource scarcity and toxicity.

Some waste materials are recycled to create construction materials with diverse applications. *Rematerialise* (Appendix 1) is an excellent online resource created by Kingston University. It lists what are referred to as 'eco smart materials', made from waste. Perhaps because of low demand or unreliable supplies of reclaimed materials, the cost of recycled products does not always seem to reflect the fact that they are essentially made from rubbish. Industries that use recycled materials may save some non-renewable resources; however, the benefit may be off-set by increased energy use in manufacture and transportation. Manufacturers' claims about their materials provide no guarantee of a contribution to sustainable design; context and independent evaluation are all important.

- 4.8.2 Understanding and using basic guidelines for material specification is a more realistic option. These rely on two key principles: minimising resource consumption and reducing pollution.

As a rule, materials from renewable sources should be specified. For example, timber displaying the Forest Stewardship Council (FSC) mark is from a managed forest which does not deplete the resource. Minimum processing is involved in its extraction and manufacture, consequently it also has the advantage of low embodied energy.

Materials that are easily biodegradable should be specified over those that take many years to break down. Materials should also be chosen that do not release toxins into the environment as they decompose.

To reduce pollution, the toxicity of materials over their full life-span should be considered. Designers may have difficulty finding information about the toxicity of specific manufacturing processes and disposal techniques. However, general information on the physical and chemical properties of materials is available from organisations such as the Environment Agency (UK); for example, the Agency for Toxic Substances and Disease Registry (USA) provides toxicological profiles for over 250 priority substances.

- 4.8.3 By way of example, recycled paper has become widely available and can be confidently specified for a wide range of purposes. Material consumption is reduced by reusing virgin paper, energy consumption is reduced because it generally takes less energy to manufacture paper from reclaimed materials than virgin ones, fewer chemicals are used in the manufacture of recycled paper than virgin ones and less paper is incinerated or put into landfill which reduces waste and pollution. An increasing number of design consultancies are adopting environmental policies. In accordance with their environmental policy, Calverts' encourage the use of recycled paper grades to all their clients.

- 4.8.4 A useful checklist for selecting materials appears in *The Eco-design Handbook* (Fuad-Luke, 2002, 282). This provides the criteria by which a designer can assess a material's environmental impact.

5.0 Evaluating sustainability

5.1 Methods

From the above it should be clear that the designer needs an increased knowledge of a material to know what environmental impact it threatens and what the most sustainable option is. Technical specifications are important; however, this information is only useful to a designer if the environmental impact of one material can be directly compared with another. This requires an understanding of the criteria by which options can be evaluated and compared.

5.1.1 Evaluation and assessment methods that already exist include:

- Life Cycle Assessment – LCA
- Environmental Accounting Method – EAS
- Environmental Preference Method
- Ecoscarcity Method.

Though their methodologies may vary, these all attempt to quantify environmental impact objectively by taking into account:

- extraction of raw materials, processing and transportation,
- reuse or recycling potential, and national and international limits for pollutants released.

Different methods of evaluation will rate materials differently, therefore criteria should be checked carefully when analysing results. For example, a Swedish study compared linoleum, vinyl and pine flooring using three different methods of evaluation. Pine floor was judged the best by all three. The Ecoscarcity and Environmental Preference methods rated lino and vinyl equal, but lino was preferred to vinyl in the EAS method (Berge, 2001, xviii).

Another consideration is that no evaluation method can be entirely objective. Judgments on 'how the destruction of the rainforests ranks in comparison with the destruction of the ozone layer, and what impacts can be accepted or traded off against products or processes that are even more damaging' are at least in part subjective (Borer & Harris, 1998, 79).

Tables of environmental assessment data such as those in *The Whole House Book* (ibid.) can be used to compare materials and determine their relative merits. There are other listings of materials and products available but usually they do not test claims made by manufacturers and suppliers. In the case of Green Seal research does precede selection and publication of data on their website (see below 5.2.6 and Appendix 1).

5.2 Environmental accreditations

- 5.2.1 Given that the science underpinning sustainability issues is developing apace, it is perhaps unrealistic to expect a designer to have the knowledge to evaluate the many products and materials available to address them. As noted above, it is also unwise to assume that the sustainability claims manufacturers and suppliers make for their products are always up to date and reliable.

The accreditation schemes and quality marks that various independent bodies offer, including trade associations and non-profit organisations, provide guidance to the designer. But there is no universally agreed system of standards that might assure greater confidence in the sustainability of accredited materials, products and services.

Gray & Bebbington (2001) provide an explanation of the origins, benefits and limitations of the existing forms of accreditation for business operation.

- 5.2.2 Forest Stewardship Council - FSC

The FSC is an international non-profit organisation set up to encourage sustainable practices in forestry worldwide. Companies can use the FSC logo once they have completed the sustainable harvest certification process. The criteria for a sustainable forest include renewing the resource (replanting trees), protecting biodiversity, water sources and soil composition, and serving community interests.

- 5.2.3 Environmental Audit and Management Systems (EMS)

BS7750 was probably the first attempt at an international standard for EMS. Launched in 1991 it was superseded by ISO 14001 in 1997. This is an environmental standard developed by the International Standards Organisation in Switzerland. Companies that achieve ISO 14001 have proved that they have an environmental policy in place, a means of identifying key issues, a systematic monitoring of these and a commitment to continuous improvement. There is an even more rigorous standard set by the European Union, the Eco-Management and Audit Scheme (EMAS). This additionally requires site-specific target setting, disclosure and verification of achievements.

Both ISO 14001 and EMAS are voluntary schemes. This means that there are companies who have a suitable sustainability policy, are monitoring its implementation, and are achieving measurable improvements but have neither forms of accreditation because they have not submitted to the audit process.

- 5.2.4 Green Mark Award Scheme

This scheme guides businesses through the development of an environmental policy and adoption of a basic environmental

management system. This can be used as a stepping stone to full ISO14001 accreditation. The three levels of the scheme are awarded for ongoing commitment to and improved employment of environmental policies. The award can be seen by designers as a measure of a company's level of environmental excellence.

5.2.5 The European Community Ecolabel

The flower symbol appears on products that achieve high environmental standards. The label is only awarded to goods and services that meet criteria concerned with minimising the impact of consumer products on the environment.

5.2.6 Green Seal

Green Seal is an independent, non-profit organisation which identifies and promotes products and services that produce reduced toxic pollution and waste, conserve resources and habitats, and minimise global warming and ozone depletion.

It is government and foundation funded so should be independent of commercial interests, though it does provide a directory of the commercial organisations it recommends. Their policy statement stresses that all publications that have such listings and links are only recommendations: it is not an accrediting body.

6.0 Opportunities for change

6.1 The role of the designer

Designers have a direct role in industry as service providers. They also have the scope to adopt a broader role that recognises the part their profession plays in shaping society and in minimising or reducing the impact of industries on the environment. Rising to this challenge requires a commitment to continued learning and embracing new ideas and practices.

6.2 Sustainability policies

6.2.1 It has long been recognised that designers have a role to play in influencing how we use resources and ensuring a sustainable future. Some professional design bodies have established ethical codes of practice.

The Chartered Society of Designers (CSD) states in its draft 1990 code of conduct,

Members shall have due regard to the effect of their work and endeavour that it may cause as little harm as possible to the ecology or environment. Members shall encourage the conservation of energy and the recycling of used products, packaging and materials.

One cannot be surprised to find policy statements such as this from internationally recognised professional bodies but one wonders how many members adopt them or are even aware of them. Whilst designers might respect these codes of practice in principle most have yet to develop sustainable environmental policies of their own.

6.2.2 One may also make a useful distinction between those designers who run a sustainable business and those who practise sustainable design.

Measures such as recycling paper waste and printer ink cartridges, and using effective lighting and heating control systems to reduce energy consumption in the office do help a design company to project a positive message to clients. Increasingly, public sector and corporate clients will only engage service providers that have an explicit environmental policy covering sustainable business practice.

Extending an environmental policy to the provision of sustainable design solutions is a step few designers are yet prepared to take. However, there are potential benefits for both designer and client.

- 6.2.3 Designers that do have a comprehensive environmental policy can communicate their achievements on past projects to potential clients when pitching for work.

A sustainable design approach to exhibits that address a public audience and have a longer term use can be a persuasive proposition. Potentially it offers business advantage, community benefit and enhances environmental quality, all considerations that may directly interest the client.

Although, business-to-business (B2B) communications tend to emphasise short-term considerations, and are therefore more resistant to a sustainable design approach, the process can nevertheless help broaden clients' horizons.

- 6.2.4 A company that has adopted a comprehensive environmental policy is Calverts, who have been given the Green Mark level 2 Award, (See 4.7.6 and 4.8.3 above, and appendix 1 section 4).

Another example of a company that has adopted a written sustainable policy is 3M, who introduced their Pollution Prevention Plus programme in 1988. It is designed to reduce waste and solvent emissions at source and introduced environmental practices in their manufacturing process. 3M has benefited from this programme in substantial cost savings for the company. They are also raising their employees' knowledge of environmental issues by encouraging them to identify additional ways of cutting pollution.

6.3 Cross-discipline collaboration

- 6.3.1 As noted above, designers need to engage with new ideas and practices which may take them beyond their immediate field of expertise. They need to be aware of environmental issues and advances in the broader field of sustainable design. By subscribing to environmental organisations, trade associations and specialist publications designers can keep abreast of new research. However, where gaps in knowledge are identified it is worth considering liaising with environment experts and consultancies, and when appropriate commissioning project-specific research.

The need to consider environment issues and executional details at an early stage in the design process will mean that close partnerships with other contributors to the programme – engineers, printers, construction companies, technologists – will be essential. (MacKenzie, 1991, 158-9)

- 6.3.2 Lack of cross-disciplinary collaboration in the early stages of projects is one probable reason for their failure to achieve sustainability.

In projects for new exhibition buildings Land Design Studio advocates involvement of exhibition designers from the beginning of the design

process so that facilities can be designed to satisfy the full range of users' needs, including provision of an effective and renewable communicative environment. They encourage clients to engage them at the start of a project to work with the architect and engineers rather than later on once the building design is fixed.

An example of this successful approach is The Deep, in Kingston upon Hull, where architect Terry Farrell and exhibition designer John Csaky collaborated with other key specialists over a period of three and half years to produce a thoroughly integrated design solution.

For this approach to become widely adopted good coverage in trade and professional publications is needed.

6.4 Education

- 6.4.1 The National Qualifications Framework (UK) provides benchmark statements for all undergraduate study. The architecture subject benchmarks are explicit about coverage of environmental issues and sustainable design in the curriculum; the art and design ones refer to environmental issues in contextual studies but do not explicitly refer to sustainable design in the curriculum.

Students need some knowledge of what impact design and manufacturing processes have on the environment to be able to adopt sustainable design practices. One can conclude that all design courses should at least include environmental issues in the curriculum and preferably should integrate them with design learning. Given the rapid development of the field students could also be encouraged to engage in research and thereby contribute to better understanding.

- 6.4.2 In professional practice multidisciplinary collaboration is important, as noted above. This should be asserted early in a designer's career through engaging as a student in cross-disciplinary design projects and sharing ideas and resources with students on other design courses as well as those in engineering or construction.

The practitioner of sustainable design needs to develop a perspective on how design processes fit into broader social, economic and political context. This suggests the need for a theoretical framework that goes beyond environmental issues. Design students might benefit from a philosophical strand to their education. The ability to question and rethink design briefs and accepted practices is likely to mark out strong designers for whom sustainability is just one of the many challenges they can overcome.

The Royal Society of Arts annual student awards (RSA Directions), for example, provide many opportunities for students to form cross-disciplinary teams to develop project submissions that question

accepted norms, are innovative in technical, business and creative terms, and exemplify sustainable design.

7.0 Conclusions

7.1 Further research and integration of knowledge

Prior to starting research the author was not aware of an existing knowledge base specific to sustainable small scale interactive and travelling exhibits. Consequently, initial searches had to look to the wider design and construction industries to find relevant examples, precedents and references. This proved to be a useful approach and pointed to the need for multi-disciplinary and industry-wide knowledge sharing to make sustainability a realisable prospect for most designers.

At this stage of the research, it is clear that resources exist that are immediately useful to exhibit designers. However, they are disparate and, without an understanding of the broader issues, difficult to use to full advantage. The hope, therefore, is that this report will provide a basis for further research.

7.2 Collaboration and balance of concerns

Where responsibilities are shifted from one party to another and adversarial relationships and buck-passing attitudes prevail, short-termism and unsustainable practices are likely to continue. A business environment conducive to the desired changes in practice is more likely to emerge where client, designer and contractor are able to negotiate a common understanding and approach. In this regard any of the key participants in a project can provide leadership towards sustainability.

Much of what the design industry produces is ephemeral and therefore 'superficial'. That is, surface and appearance are dominating concerns. The vast palette of materials available means that designers can quickly and easily alter the public's perceptions of a product by transforming its visual and tactile qualities.

Hopefully this report shows that sustainable design is about more than the selection of a few organic or recycled materials and involves a wider balance of concerns. In a travelling exhibit project, for example, it means shaping the exhibition programme and the context of use, accounting for the energy used in production, operation and disposal, and evaluating alternative solutions against rigorous criteria set out in the brief.

7.3. Communication and technology

Because good communication can be low-tech as often as high-tech, use new technologies or older ones, exhibit design can be seen as independent of specific technical means. In ideal circumstances,

therefore, the designer is free to choose technologies that will improve exhibition sustainability incrementally.

7.4 Business environment for sustainable design

A possible way forward is to include environmental performance criteria in tender specifications. How well this is likely to be received by contractors is an open question. In the context of compulsory competitive tendering processes there is a tendency towards technological conservatism and a resistance to process innovation. Consequently, bidders may pull out of competition if they feel they do not have the knowledge or expertise to comply with special criteria or are uncertain about the financial viability of their participation in a project.

Clearly there is still some way to go to create a business environment that fully facilitates sustainable design initiatives. However, key resources continue to be depleted and environmental legislation and industrial regulation continue to change generally in the direction of advancing sustainability. Designing and manufacturing sustainably may become economically attractive sooner rather than later and in this situation those already using sustainable practices will have the business advantage.

7.5 The need for case study evaluation

This study was limited in its ambitions, a beginning for the subject of sustainable exhibit design. What the research carried out for this report shows is the lack of relevant case studies on which to base in-depth empirical study.

One direction for future research, therefore, is to make an industry-wide call for case studies and to adapt and apply evaluation techniques to their analysis. Taking into account the context and brief of each type of case study these might include, for example, eco-efficiency tests, environmental impact analyses, and life cycle assessments.

7.6 Concluding remarks

Few exhibition design projects afford the resources to conduct original research into sustainable technology options. What tends to happen is that designers adopt materials and methods proven in practice, published in reputable journals, endorsed by recognised trade or environmental organisations, and disseminated via professional training events.

Hopefully this report shows that sustainability, as much as a common sense approach to problem solving, is central to a good design

philosophy. Sustainable design can be a pragmatic approach to materials and construction that saves just a little time, money or physical resource. This is not difficult to achieve. A project does not have to be planet saving; it is enough if it takes a small step in the right direction.

However, for those who wish to take it, there is a further challenge. Broadening a philosophical understanding of sustainable design seems essential to its success. We suggest that this will develop out of serious critical reflection on hard-won experience and points to the need for further collaboration between practising designers and university design departments.

Appendix 1 – Useful organisations and sources

	Resource	Main activity	Contact	Quick reference
1	ORGANISATIONS			
	Agency for Toxic Substances and Disease Registry (USA).	A federal public health agency – provides information to prevent harmful exposures and diseases related to toxic substances.	www.atsdr.cdc.gov	information/toxic substances
	Building Centre	Information and exhibition centre for building products.	www.buildingcentre.co.uk	Information/materials
	Building Research Establishment	Developed an Environmental Assessment Method (BREEAM) for buildings and provides environmental profiles database for materials. Publishes <i>The Green Guide to Specification</i> .	www.bre.co.uk/service.jsp?id=53 click on environmental profiles database	Environmental profiles database
	Centre for Alternative Technology	Education and display centre demonstrating renewable energy and environmental building, provides info and consultancy services.	www.cat.org.uk	Information/web links
	The Centre for Sustainable Design	Facilitates discussion and research on eco-design and 3E's (environmental, economic, ethical and social issues).	www.cfsd.org.uk	Design management

	Design Council	Design industry promotion. Website includes a brief introduction to Sustainable Design	www.designcouncil.org.uk	Design/information
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	Resource	Main activity	Contact	Quick reference
	Energy Saving Trust	Non-profit UK organisation set up to provide information to facilitate compliance with CO ² emissions reduction. Includes an advice section for building industry professionals.	www.est.org.uk	Renewable energy/ transport planning/ clean fuels
	Environmentally Sustainable Product Design	ESP Design is an online resource for design professionals and students seeking to learn about Sustainable Product Design.	www.espdesign.org	Theory/further reading/ web links
	Environment Agency	UK Government site includes detailed explanation of landfill use, regulation and reduction policy.	www.environment-agency.gov.uk	Waste/ pollution
	Evnymos Ecological Library	Greek non-profit organisation has an online library and environmental database in English.	http://demos.neuron.gr/evonyms/english/	Materials/ Information/ Environmental database
	Friends of the Earth	Ecological information.	www.foe.co.uk	Ecology
	Forestry Stewardship Council	Encourage the use of sustainable practices in forestry worldwide.	www.fsc.org	Product database

	Resource	Main activity	Contact	Quick reference
	Green Building Digest	A subscription-only product information service provided by the School of Architecture at Queen's University, Belfast.	www.qub.ac.uk/arc/research/gbd/index.html	Building and construction materials
	Green Seal	Non-profit US organisation promoting green products and materials. Their Choose Green reports cover a range of material types and have recommendations supported by scientific findings.	www.greenseal.org	MDF/particle board/ carpet/ wood finishes/ lighting
	Information Inspiration	Eco-design resource initiated by Loughborough University that supports industrial designers involvement in environmental projects.	www.informationinspiration.org.uk	Theory/ case studies/ materials
	Inform Design	Website providing research findings including sustainability useful to designers. Created by University of Minnesota.	www.informedesign.umn.edu www.msdcg.umn.edu	Information /case studies
	London Remade	Aims to increase markets for recycled products and develop recycling supply chain.	www.londonremade.com	recycling
	Rematerialise	On-line resource database.	www.kingston.ac.uk/rematerialise	materials library/useful links

	Resource	Main activity	Contact	Quick reference
	Reuze	Aims to bring together the 3 strands of recycling. Those with waste to recycle, organisations that reuse that waste and products made from recycled waste.	www.reuze.org.uk	Recycling
	RIBA	Online database to search RIBA library of 30,000bks, 150,000 articles and 300 periodicals.	www.riba.org	Information
	TRADA	Information providers for timber industry, species database, suppliers directory, technical library.	www.trada.co.uk	timber
	Waste Online	Information resource on waste provided by Waste Watch.	www.wasteonline.org.uk	
	WRAP Waste & Resources Action Programme	Aims to create markets for recycled materials, campaigns to reduce waste, advisory service for local authorities. Product directory.	www.wrap.org.uk	Recycling/ product directory
	Worldwatch Institute	Independent research for an environmentally sustainable and socially just society.	www.worldwatch.org	Global reporting

	Resource	Main activity	Contact	Quick reference
2	SUPPLIER/ PRODUCER/ COMMERCIAL			
	Alde & Ot	Produces soy based inks.		Ink
	Auro Paints	Produces gloss, varnish, adhesives and polishes.	www.auroorganic.co.uk	paints
	Biothinking	Educational resource on how the world operates on biological principles. <i>Biothinking</i> results in products, processes and business models that are adaptable, sustainable and well designed.	www.biothinking.com	Business strategy
	Construction Resources	UK ecological builders merchant.	www.constructionresources.com	Building products
	Curtis Fine Papers	Recycled uncoated paper.	www.curtisfinepapers.com	paper
	Dabbrook Power systems	Specialist designers and installers of renewable energy systems.	www.dabbrook.com	energy
	Flint Ink	Produces vegetable based inks.		Ink
	Green Building Store	Online shop for green building products. Includes description of benefits for some products.	www.greenbuildingstore.co.uk	paints/ construction materials

	Resource	Main activity	Contact	Quick reference
	Interface	Collects and reconditions carpet tiles for reuse and monitors CO ² emissions Research arm maintains a sustainability website.	www.interfaceeurope.com/uk www.interfacesustainability.com	carpet
	Lakeland paints	Odourless, solvent free paints.	www.ecos.me.uk	paint
	Lili Environmental systems LTD	Designs, manufactures and researches all types of renewable energy solutions. Offers consultancy and feasibility studies on renewable energy.	www.lowimpact.org	energy
	Nutshell Natural Paints	Environmentally friendly and natural alternative to petrochemical paints and varnishes.	www.nutshellpaints.com	paint
	Ordnance Survey	Online shop for Code Point, postcode intelligence software.	www.ordnancesurvey.co.uk	Transport planning /postcode intelligence
	Paperback	Gloss and matt coated papers.	www.paperback.coop	paper
	Rohner Textil	Produces Climatex Lifecycle a biodegradable upholstery fabric that is manufactured with a waste minimising process.		fabric

	Resource	Main activity	Contact	Quick reference
3	LITERATURE			
	Article: Bruford, G. (2000) Environmental Merits of Timber, McMillan-Scott plc.	Materials and the environment, Life Cycle assessment, Environmental profiles, environmental profile of timber, further research, conclusion.	www.trada.co.uk	timber
	Article: Otto, B. K. (2005) About: Sustainability, Design Council, UK.	Beatrice Otto is a consultant on sustainable design and discusses relevant issues in this article.	www.designcouncil.org.uk click on emerging issues: sustainability to download pdf file of Otto's article	Design theory
	Report: Middleton, D. & P. Laybourn (2002) The Sustainable Exhibition Industry Project, MEBC.	A comprehensive report on the first two years of the SEXI project, including the survey of attitudes and practices in waste management in the exhibitions industry.	www.aeo.org.uk/files/sexi_report.pdf download 32 page document	Waste
4	DESIGNERS			
	Calverts Design and Print Cooperative, London	Produces exhibition materials, publications, posters, flyers and trade print. Has adopted a comprehensive environmental policy.	www.calverts.coop/	Design/ environmental policy
	Land Design Studio	Design consultancy 'Earth Today and Tomorrow' at Natural History Museum, London. UK Pavilion EXPO 2005, Aichi, Japan.	www.landdesignstudio.co.uk	Design/ case study

	Niall McLaughlin Architects	Architects, ARC the centre for architectural excellence in Hull, UK.	www.niallmclaughlin.com	Exhibition architecture/case study
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Appendix 2 – Interview Transcripts

Interview 1 – Carrie Wiltshire, Centre for Alternative Technology (CAT)

1. Name and contact details:

Carrie Wiltshire,
Centre for Alternative Technology
Machynlleth, Powys, Wales, UK
SY20 9AZ
Tel:01654 704963
carrie.wiltshire@cat.org.uk
Info Line Tel +44 (0) 1654 705960 Fax +44 (0) 1654 702782

2. Job title: Interpretation and Display Coordinator

3. Brief description of role and responsibilities

I job share with partner Peter Callum who is other half of display and interpretation team. I am responsible for the interpretation and Peter does the design. The department is responsible for the displays in the Visitor Centre and the Centre for Alternative Technology, this includes maintaining existing displays, developing new ones and updating information. Other departments do small temporary exhibitions but they liase with us to make sure design and text is in accordance with the display departments standards.

Note: Department only in existence for 2 years.

SUSTAINABLE PRACTICES

4. Does your organisation have a sustainable design policy? Written guidelines?

Available to us?

Not a formal one, due to the type of organisation they are it is taken for granted that the practices we employ will be in accordance with sustainable ethics.

5. Do you have any experience of designing/specifying/producing exhibits according to sustainable principles...

6. If yes how did you achieve this, did it include the materials used, energy and pollution in production processes, the maintenance and renewability of the exhibits, energy used in the running of the exhibits.

The organisation as a whole has lots of experience designing with sustainable principles. In the past work has been contracted out in accordance with CAT's specifications but now that there is a display department all of the displays are designed in terms of best practice in terms of environmental concerns. We are currently in the middle of redoing 3 parts of our display circuit, and certain considerations have to be taken into account. We have 60,000 visitors a year which influences the choices we make. Most of the displays are outside and open to the elements, so they have to be durable and easily maintained. For example during the current project 'Bringing the Future Forward' weatherproof shelters had to be created for the displays, when looking at the construction we had to make decisions about materials. At one point the initial concept was for a platform with a canopy. The materials we looked at for this ranged from organic hemp through to PVC and other fabrics. PVC would be the most durable and easy to clean and although it can be recycled we were not comfortable specifying

it. So we dismissed the idea of a canopy altogether and went for a glass roof. Taking into account the issue of sustainability had to be central to the design development and a glass roof met our requirements. The problem with specifying hemp is it would have to be impregnated with chemicals to be durable which we would also want to avoid. Natural Hemp would not last a season, it would weather poorly and start to deteriorate and look mouldy. We are keen to make sure that people don't think of sustainable living as high maintenance or substandard to mainstream requirements; people like their environment to be clean and tidy and there's no reason a sustainable one shouldn't provide this.

How did the glass roof meet your environmental standards?

It came from a recycled source, is made from recycled glass and can be recycled in the future. It is also hardwearing and will not need replacing in five years unlike hemp. The environmental footprint of having to replace a hemp canopy on a regular basis probably exceeds the footprint resulting from constructing it from glass in the first place

Do you think of pollution involved in processing materials before construction begins?

In terms of materials CAT as a whole does think of carbon footprinting, we have an awareness of the history of materials and the environmental impact in their production. We make their decisions based on that.

How do you find out about carbon footprint of a material?

Gary in the Education Dept is a leading proponent in this method of evaluating materials, it informs a lot of CAT's activities. Research dept also produces info in this area.

Do they publish anything on these guidelines?

Information department provide this info and can act as an intermediary between people requiring information and suppliers. Publications department has published books regarding building material sustainable building. But for specific information relating to displays the information department would be best place to help.

Display material example: Foamex is used as a printing medium for display boards which we would prefer not to use, it is composed of toxic, non biodegradable, non recyclable materials,. We are now looking at printing on fabric instead of boards. Printing technologies today allow for a variety of mediums to be used and rather than materials being a constraint it's a budgetary one.

Polycarbonate can be an alternative to Foamex as it is biodegradable. We have to weigh up pros and cons when choosing materials as to what aesthetic result is required and achievable.

7. Do you follow any other written guidelines?

Building department do and we would defer to them with questions.

8. If so, what are these and where did they originate? N/A

9. Do you use any suppliers whom you know to have environmental credentials, for example graphic designers, printers, lighting designers, model-makers, fit-out companies? Do you know what practices they employed? Could you provide me with contact details.

We do not have a standard list of suppliers as most things are produced in-house, but we are using a graphic designer on our current project called Stephen Murphy. We could provide a list at the end of the project.

**10. What sources of information do you use to assist you in this aspect of your work?
N/A**

11. Are there any industry-recognised standard materials, products or processes which you know to be either environmentally harmful or benign?

That's a very broad question, there is no blanket ruling as to whether we specify recycled materials as a priority, or whether reducing energy consumption is the main consideration. We can only judge on case by case basis. For example it is good practice to use recycled materials. However, if they are made from Styrofoam cups and derivative products we would much rather say don't use Styrofoam at all. The ideal is to reduce consumption of non-renewable/ non- sustainable resources in first instance and then recycling as a solution to reducing consumption further. We try not to use concrete and specify limecrete instead. But there is still some debate regarding this, due to durability and cost.

WASTE & DISMANTLING

12. What provision do you make for dealing with waste?

We minimise the amount of waste we produce and specify recycled materials but we also reuse stuff. For example, we have some solar water heating panels that have been on display for a long time which are outdated. We plan to reuse them for training purposes on the courses we offer as they are still functional, just not cutting edge enough for display.

13. Do companies come and collect waste for recycling?

Locally we have the swap shop; it depends on the amount of material. We have been offered hubs from decommissioned wind turbines which are. Plastic and paper is collected from visitors and offices which is collected by the council. Visitors are asked to separate waste into appropriate bins, and we give them lots of opportunities to do so. Not sure if there is a minimum amount companies will collect. A separate company collects Tetrapacs. You could look for them on the internet.

ENERGY

14. How do you monitor energy use of your own, of your suppliers' processes?

We are self sufficient in terms of energy production; we have hydro, wind turbines and solar panels. Excess electricity is sold back to the grid and sometimes we buy from grid. The engineering department will have information on the amount of energy produced. They are currently installing a monitoring system called - SCADA Site [...] Data Acquisition. This is for whole site and couldn't be broken down into the amount of energy used for displays. For suppliers' energy consumption you would have to contact the information department.

15. Is the energy supply for your exhibits from a renewable source? If yes how is this achieved. [Yes, see above.]

16. Do you know if it is possible to use/ do you have experience of a renewable energy source to power an exhibition on a temporary basis?

All energy is produced on a site-wide system here. We are connected to the grid in case there is a shortfall in the amount of energy produced; changeable weather can affect this. We do have a solar powered telephone box - provides the light. If required we could use a renewable energy source on temporary basis because they have engineering dept so have expertise on site therefore cost would be reduced.

Would it be viable to power an exhibition this way?

It depends where display is, what type of equipment is employed, the energy requirements. There are too many permutations to give an answer. If it was on a small scale e.g. solar powered boat on a pond that is simple and they

have a kit in shop, but to run a DVD then it's more complex and would need technical knowledge.

17. Do you know of companies that hire out solar/wind equipment for use in exhibits.
No.

18. Do you know how designers can find out about energy use in the production processes? Refer to information department.

TRANSPORT

19. Are you able to minimise transport during installation of exhibitions? E.g. did you source materials and suppliers locally, did you dematerialise and therefore have less to transport, did you amalgamate transport of various items?

Yes, we try to source from local suppliers as much as possible and that also feeds back into local economy. CAT did a travelling exhibition called 'Our Planet' where we may have taken measures to reduce transport. Look for details on the website. Generally our displays are on-site and we have the capability of manufacturing things here. We have a company doing interactives for the new displays. They are based in Manchester and we've come to an agreement with them for the development and the evaluation stage. This would normally be done on-site but we've agreed for the company to test the interactives with local school children. As a result environmental and financial costs aren't incurred by unnecessary transport between site and workshop for testing and modification. They've done a site visit and they know what criteria the interactive has to meet. It is preferable for a person to travel there than all the objects transported to site. So by writing detailed brief and being very specific in drawing up requirements a company can be allowed to evaluate itself which rules out the need for making extra visits to site.

20. In general are visitors encouraged to visit the Centre using public transport? How do you promote this?

Yes we give a discount to people who produce a train/bus ticket or come by bike. We promote this on our leaflets and website.

Is this system open to corruption?

Our policy is to trust people and the percentage of people who lied would be so small that losses would be negligible. It's better to have good customer relations and to convey the message of using environmentally good policies. Losses would not make a lot of difference in terms of income. Due to our location the main form of transport is actually car.

PERFORMANCE/ VISITOR EXPERIENCE

21. Do any sustainable practices have any particular performance enhancements or restrictions outside of their environmental considerations?

There is always a process of experimentation going on at the Centre which is part of the organisation's remit. I can't think of specific examples.

22. Do you have experience of any maintenance issues that are specific to sustainable exhibits?

No, there are issues regardless of sustainable properties, people will just tear things apart

23. Are visitor perceptions evaluated?

Yes, they are generally very good.

Do they pick up on the sustainable methods you've used?

Yes, because of the type of centre we are, if we were a science centre about a different topic they may not pick up on it. Some people look for where they fall down on it.

24. Obviously part of the Centre's role is to educate on environmental issues and so visitors might assume that the buildings and their interiors are environmentally friendly but do you publicise this fact? What methods do you use to communicate this information?

With hands-on and practical examples, rather than just being about displays, we are a living working environmental centre, its always worth people seeing things in action, but where we do interpretation our policy is to try to introduce hands-on means. Standard graphics are used and we have a handheld audio tour which uses rechargeable batteries. I think if a company has an environmental policy it should be publicised. It's more common amongst manufacturers, because it's a good marketing tool. Also industry regulations influence this.

GENERAL

25. What have you found is the most problematic aspect of sustainability?

Cost is the most prohibitive, there are products out there which do meet our criteria but budget constraints make them unviable. In some instances cost can be an incentive and some sustainable methods will be cost effective. We've used some fenceposts in children's play which are made from recycled wellies and toothbrushes, they have good aesthetic qualities but couldn't be used on a larger scale as the costs would escalate disproportionately. In construction we use bits of trees that are left over after planks have been made, this does reduce costs.

26. What is the most achievable aspect of sustainability? Which methods of sustainable design do you think are most successful in lessening the detrimental effect on the environment?

Our energy consumption is low because we produce our own and waste reduction is high. But because of our status as an environmental centre it is ingrained in our philosophy and it's hard to pinpoint one thing over another.

27. How significant are the benefits if an exhibition designer follows sustainable design practices, in financial terms, to company, to environment?

Bringing an environmental conscience into the mainstream is important, there is still quite a lot of resistance amongst the general public that these things can look modern and be part of the mainstream without compromising performance and aesthetics. Every little bit helps. From some of our evaluations on public attitudes towards sustainability the role of the individual is very minimal. Individuals think any efforts they make are a small drop in the ocean and that the onus is on governments to introduce policies. But the individual can make a difference, and need to take part in the lobbying process and people have to be aware of the issues.

FURTHER INFO

28. Can you recommend any good publications that would be relevant to this field of research

No books on self-build, no books on exhibition design.

29. Do you know of any exhibitions/exhibition designers that set a good precedent of how to follow the principles and practices of sustainable design?

[Use because we do everything in house staff.] There is the Ecohouse in Leicester www.environ.org.uk

CF conclusions:

All decisions have to be made on a case-by-case basis, ie the specification of materials depends on their use and what options are available and whether these include environmental alternatives. Does the use of an environmentally sound product outweigh its poor durability for example? The problem with trying to set out general guidelines is that it is hard to make blanket rulings where there is little precedents to follow regarding which strategies have been successfully employed. Also where a strategy is successful in one instance, differing requirements and considerations will make it unviable in another situation.

To find solutions to some sustainable design issues it seems you need to know what questions to ask before you can come up with a solution, ie as an energy saving measure photovoltaic cells could be installed but the feasibility of using them depends on how much energy needs to be generated, climate conditions, time of year, geography and cost effectiveness. This information can only be supplied once a designer is working on an actual project.

One solution would be for design practices to have a policy that considers sustainability wherever possible. To then be successful in meeting targets means they need to know the issues involved and the questions that need to be asked at each stage of the design process.

Interview 2 – Peter Higgins, Land Design Studio

1. Name and contact details

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info@landdesignstudio.co.uk
Tel: 020 83326699 Mob: 07802883260

2. Job title: Creative Director of Land Design Studio, London

3. Role and Responsibilities

SUSTAINABLE PRACTICES

4. Does your organisation have a sustainable design policy? Written guidelines?

Not specifically although we have to fulfil the need with some applications for some projects but we don't have an in-house guideline developed but we respond as and when we have to.

Have you any plans put anything in writing?

Not really, no.

5. Do you have any experience of designing exhibits according to sustainable principles? If yes, how did you achieve it?

There are two things to mention immediately. We worked on the Playzone at the Millennium Dome and what was then called the NME, the New Millennium Experience, who were the overall controlling body of the Dome, implemented incredibly rigorous guidelines to do with how everything was disposed of after

the Dome closed. It was very onerous and the use of many types of synthetic materials was of concern and we had to prove that everything we used could be disposed of responsibly and easily.

Other things we are involved with, in much more specific terms, are to do with material specifications. For example, the use of MDF in exhibition cases is avoided, which is now widely recognised.

We also did a touring exhibition for the Natural History Museum called 'Dinobirds' where we used a pressed recycled timber called paralam and that was intentionally chosen because of the recycled nature of the product. Its mottled appearance can mean it has limitations and it's also quite expensive.

We also use quite a lot of recycled plastic. We used it on the ECOS project and with ECOS we did try and maintain some environmentally friendly standards.

How were the things from the Playzone disposed of, did they go to schools for example?

No it was more to do with if you wanted to use a large amount of PVC, we had to know what the residual material might be and where and how it would be disposed of, and we had to change decisions about certain materials accordingly.

6. Could you tell me why you were awarded the Civic Trust Sustainability Award, and the D&AD Silver Nomination for Environmental Design and Architecture? Were they more for content rather than practices?

It's a misnomer 'environmental design'. The award concerns the exhibition design and spatial design. The award for the ECOS job, which was a generic project about ecology, wasn't about the construction of the exhibition but about the content.

7. Do you follow any other written guidelines?

In general terms we have method statements, which we are asked to adhere to, Health and Safety, equal opportunities etc. nothing relevant to the sustainable design topic.

8. When specifying materials do you take into account the production processes?

Yes, there are very clear guidelines now on the use of unsustainable timbers. We are all very aware now of selecting materials that are sustainable.

Do you find it easy to discover the processes used in manufacturing and technical data?

Not really, no. It would be useful to have a manual.

Part of this project is to try and compile a technical database of material.

Yes, that would be good

9. Do you use any suppliers whom you know to have environmental credentials, for example, graphic designers, printers, lighting designers, model-makers, fit-out companies? Do you know what practices they employed? Could you provide me with contact details?

I think most of the people we use have a knowledge and awareness but no one capitalises on it.

10. Are there any industry-recognised standard materials, products or processes that you know to be either environmentally harmful or benign?

No, the big drive at the moment that concerns us in terms of social responsibility is the DDA – the Disability Discrimination Act. At the moment it is our preoccupation; it concerns accessibility for the disabled and the quality of experience. We're currently doing a very big job in Swansea involving sign language and it's really hugely developed in terms of legibility and the use of

sound and the quality of experience. It's become much more of a priority and is a fashionable issue that everyone is interested in at the moment.

Do you think this is due to the new legislation?

Yes.

So for sustainability to become a priority pushing for legislation is a key factor.

WASTE & DISMANTLING

11. What provision do you make for dealing with waste e.g. minimising the amount of waste produced in construction of an exhibition?

To be honest none whatsoever; that is entirely the responsibility of our contractors we have no say in how they deal with their waste. That's part of their manufacturing and it's entirely their choice. We can't begin to insist on certain protocols in their manufacturing process. If you require contractors to make considerations about waste you have to remember that when bidding for work it is often the lowest bid that is chosen and we're driven by selecting contractors guided by price and reliability and how they run a job. If we said it's really important how you dispose of your waste material it would completely confuse the bidding process. We never know how they deal with their waste and it would be hard to know how they would meet the requirement. It's a nice idea but pretty much impractical.

12. Do companies come and collect waste for recycling? Do you specify materials that are biodegradable?

We did have recycled envelopes but they were quite hard to get hold of so we don't know. We did used to have all our waste paper removed but since changing offices ...

ENERGY

13. How do you monitor energy use of your own, of your suppliers processes?

No, not at all.

14. Have you ever used a renewable energy source for any of your exhibitions? For example ECOS centre has a conical core supporting photovoltaic system. Any other examples: Nat Hist backlighting. ECOS - Deflecting light via a direction mirror is used to power objects. This fits in with the Centres educational objectives but has LDS used alternative power sources in other interactive exhibits?

The answer is no, the reason being it is not well enough developed, we've done a lot of exhibitions that describe what renewable energy is but we've never run anything from it. It is often too expensive. Realistically, energy sources used for an exhibition are supplied by the building it is housed in. The ECOS Centre did have photovoltaic cells on the roof and it could be argued that that building was as environmentally considered as anything we've worked on.

Can you explain how mirrors were used to deflect light for use as an energy source in one of the ECOS exhibits?

Yes, it was a little installation we made using reflected light. But it wasn't running off natural light it was from a lamp and it was to demonstrate a principle to drive electric motors using light.

At The Natural History Museum you used natural light to backlight some of your graphics. Can you talk about these?

We made some big transparencies and we clipped them to the windows.

So they were clipped to the window? Did that method come about because you were looking at ways to save energy?

Yes exactly – So it's about using the space its best advantage and being able to spot opportunities

Do you know if it's possible to use/do you have experience of a renewable energy source to power an exhibition on a temporary basis?

Extremely unlikely, it's a great idea to be able to use a renewable source of energy in an exhibition but we fall into the same trap as everybody else, it's just not powerful enough.

Yes, it depends on your energy demands and whether a system can meet the amount of Kilowatt hours needed. The cost of installation has to be outweighed by the saving made by energy produced.

Yes, you have to remember that exhibitions are run on a shoestring, [so] there isn't the capital to purchase the equipment, and then it doesn't provide enough energy.

15. Do you know of companies that hire out solar/wind equipment for use in exhibits?
No.

TRANSPORT

16. Are visitors encouraged to visit the ECOS Centre using public transport?

No, there is a classic example of failure with that in the Earth Centre at Doncaster where there was a big experiment and they made it cheaper for people who arrived by train.

Yes CAT do that.

At the Earth Centre they tried to encourage people to arrive at the exhibition by public transport but it failed miserably, people want to get in their cars basically.

[...]

It's a side issue but worth mentioning that we advocate the involvement of exhibition designers right from the beginning of the process so that the building is designed in accordance with the needs of the exhibition. This way money and energy can be saved, as we don't go in and say we don't need that light there or rip out the air conditioning. What we try to do and this is a big issue, is to try to get the client to involve us with the design from the beginning, which is what we are doing more now.

In conjunction with the architect as well?

Yes, and the engineer so that the implications of what we need for the exhibition like lighting, circulation, lack of lighting where we don't need windows for example, is integrated into the whole central master plan of the architecture and the programme of the mechanical and electrical engineering.

Do you find that if the client is unaware of how important it is for the exhibition designer to be involved at the early consultancy stages that architects will suggest you be involved?

No, they mostly don't understand how important it is. But where we have worked for long periods with architects such as Wilkinson Eyre on the Mary Rose, we started on day one with them, which was really great. It's a really important piece of methodology that should be considered I think.

How do you think you could get that ethos widely accepted amongst design professionals?

Writing articles in museum [and architectural] journals, get clients and the people that procure it to understand it. You look at projects that have failed [...] because they have not understood that as a critical part of the process.

It would help if part of University curricula got students from different design disciplines to work together on projects, so that they have an awareness of each other's roles and how they can work fruitfully together once they go out into practice.

Indirectly it's a definite energy saving method and intelligent way of creating architectural forms.

I have to go to a meeting now do you still have a lot of questions.
I do, but you've been very helpful, I'll just skip to the end and if it's alright with you I'll email you a complete set of questions so that if anything else springs to mind that may be of relevance you could let me know.

FURTHER INFO

17. Can you recommend any good publications that would be relevant to this field of research?

A book by James Wines, called *Green Architecture*, we're actually in that because we did a project with him.

Yes that's on our book list; I've requested it through inter-library loan.

It's very good I'd definitely recommend it.

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