Botanic Garden Creation and Management: the feasibility and design of new British collections

[On-line Edition]

PhD Thesis

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5 Design & Interpretation

The aim of this and the previous chapter is to individually examine activities of botanic gardens in the belief that an understanding of these will aid decision-making processes when developing a new botanical collection. This chapter will concentrate on education and how the design of the garden and its interpretation can influence the visitor.

Design and interpretation have been linked together in this section because, whilst at either ends of their spectra they are different disciplines, defining where one ends and the other starts is not easy. With regard botanic gardens it may possibly have been easier a few years ago to make a distinction by saying that design is involved in prescribing the shape of the area that held a collection, while the interpretation ensures that each object is described. However now, not only is a great deal more thought put into what is said and how but graphic design skills, as well as changes to the design of the surroundings, are all recruited to interpret the collections.

Design disciplines of all sorts, be they architectural, graphic, landscape etc. fall across this fluid border that links the sciences and the arts. That is to say that there are scientifically tested rules that can be used to guide certain areas of the process but there are also areas that require natural ability and creativity. It is interesting to note that not only are scientists and academics finding themselves encroaching on the world of the artist but artists have also started to encroach on the world of the scientist.

In 2004, at Tate Modern in London, there were two pieces of work by different artists that explored this union between scientific collection and art. The first, a piece by Damien Hirst, entitled 'Forms Without Life', consisted of a glass cabinet containing large ornate shells collected from Thailand. This piece explores the tradition of collection and questions the killing and removal of living things from their habitat. The second piece was 'Tate Thames Dig' by Mark Dion. Much of Dion's work is comprised of two parts: the first is the process, which results in the second, the piece itself. In this case Dion worked with volunteers and experts to collect items from the banks either side of the stretch of Thames by the Tate Modern gallery. These items were then cleaned and sorted into groups, e.g. bottles or padlocks etc. This process was conducted in full view of visitors to the Tate. The items were then displayed in a double-sided cabinet with pull out drawers reminiscent of old museum cabinets but left unlabelled thus requiring the viewers to provide their own interpretation.

This process of using a scientific method and its products to produce an installation is a recurrent theme in Dions work and using it he has examined the work of archaeologists (Tate Thames Dig (2003) and History Trash Scan (1996)), entomologists (A Meter of Meadow (1995) and The Great Munich Bug Hunt (1993)) and botanists (The Upper West Side Plant Project (1992)). Whilst in these pieces the underlying messages about biodiversity are not thrust on the viewer Dion has done this in others. For instance his 'Wheelbarrows of Progress' (1990) series with William Schefferine was much more didactic in its approach and looked surprisingly similar to some of the displays that can be found at the Eden Project. During an interview Miwon Kwon questioned Mark Dion about the didactic nature of his work and he explained that whilst they were didactic they "…all contained massive amounts of detail and layering…and often had counter arguments built into them." When asked what he felt art could contribute to scientific debates he responded by pointing out that "…one of the fundamental problems is that even if scientists are good at what they do, they're not necessarily adept in the field of representation. They do not have access to the rich set of tools, like irony, allegory and humour, which are the meat and potatoes of art and literature." (Corrin, Kwon & Bryson 1997)

Mark Dion also states that he thinks "…the design of museum exhibitions is an art form in and of itself, on a par with novels, paintings, sculptures and films." (Corrin, Kwon & Bryson 1997). Just as these media reflect the culture of the writer, artist, or director that produced them, so to do the designs of museums and botanic gardens, and the exhibits they contain, reflect the culture of the people who constructed them. While this may be more visible in exhibits that deal with emotive subjects, such as those examining issues around the nineteenth century slave trade, or the plight of Jews during the Second World War, the same bias is at work behind exhibits in botanical gardens. This is because any one object, be it a plant or a piece of pottery, has a number of stories that can be associated with it, and for each of these stories, as with many things in history, there are usually two sides. It is not possible to tell all these stories and therefore at some point someone has to make the decision about which is going to be presented to the visitor and how. As the ideology of the culture changes then so to does the design of museums and botanic gardens. This has been recognised by the curators of the Pitt Rivers Museum, Oxford University's museum of anthropology and world archaeology, who now actively maintain its Victorian layout and atmosphere because "The cluttered cases, the original small handwritten labels and the absence of intrusive text-panels all contribute to the special experience it offers…It is also a fascinating place for those studying changing historical attitudes." (Pitt Rivers Museum Website 2004)

Having started the introduction to this topic by saying that design and interpretation were inseparable an attempt will now be made to clarify this so that they can, as much as possible be discussed separately. Design and interpretation are the tools with which the curators of a collection communicate with its visitors. In general, interpretation involves the direct communication of ideas through language either written or spoken while design involves the communication of ideas and emotions through non-verbal media.

5.1 Interpretation

There is a commonly held belief that most people visit botanic gardens for reasons other than learning and visitor research at the Royal Botanic Garden, Sydney (RBGS) appears to support this notion. Major visitor surveys conducted in 1987, and fifteen years later in 2001, give the following reasons why people come to the RBGS.

1987	**2001**
Aesthetic purposes (32%)	Relaxation (21%)
Passive recreation (25%)	Aesthetics (19%)
Thoroughfare (17%)	Peace/tranquillity/refuge (18%)
Active recreation (9%)	Sightseeing/general interest (17%)
Special purpose (4%)	Walking/jogging (9%)
Botanic (4%)	Botanic (5%)
Other (8%)	Horticultural (3%)
	Educational (5%)
	Thoroughfare (3%)

(Hatherly 2002)

These results seem to support the idea that relaxation and aesthetic passive recreation are the main reasons. The RBGS is not unique in receiving this type of results. The 1987 survey of visitors to the Royal Botanic Gardens, Kew, as given by Burbidge (1990), supports these data.

Recreation with an interest in plants	36%
Relaxation in the open air	33%
Outing to leisure attraction	20%
Special interest in plants	7%
Educational visit	4%

However, Hatherly (2002) believes that it is a myth that visitors do not come to botanic gardens to learn, citing a 1997 RBGS 'Venue Monitor' phone survey of 1,000 people, which included a question on which activities the visitor thought the RBGS was actively involved in. Visitors to the gardens over a six-month period ranked the activities as follows:

- providing information about plants 91%
- promoting the need for conservation 71%
- providing education about the environment 67%
- publishing scientific journals 41%

Whilst it is interesting to see that the provision of plant information is so widely seen as a role of a botanic garden the survey did not establish whether respondents, as botanic garden visitors, saw themselves as the intended recipients of this information. For many people the terms 'education' and 'learning' are things that are associated with school. It is therefore not surprising that they do not associate a visit to a botanic garden with having anything to do with these concepts. However, this does not mean that they have not learned anything during a visit. Perhaps 'learned' is too strong a word to use as good interpretation can add value to an object or idea by providing a link between that object and the viewer without having embarked on a huge educational exercise. For example, Smith (2003) explains how the National Museum of Australia recently acquired the skin of a thylacine (an extinct wolf-like marsupial from Tasmania). This skin, as one of only 25 in various museums, is a valuable scientific specimen and could have been displayed as such but instead the museums staff tracked the history of that particular item and discovered that it had been used at the opening of a brewery, which

has a thylacine in its company trademark. By presenting this information, as well as the skin itself, the public now have another way in which they can relate to the object. They may then be prompted, either by themselves or through addition museum interpretation, to consider the role humans played in the demise of this and other species. In this case very little new knowledge has necessarily been learned. However, the creation of links between existing knowledge and concepts has lead to a new perspective being formed of the object and the surrounding issues.

5.1.1 Problems with Interpretation

With the possible exception of guided tours, all forms of interpretation suffer from the fundamental flaw that there is no feedback. In other words the botanic garden is having a one-sided conversation with its visitors and cannot ensure that every visitor walks away from an interpretation board having fully understood what the botanic garden has been trying to be put across. A lot can be done to minimise the chances of this happening but there are number of problems that recur. Firstly, there are those problems that are centred on the diversity of visitor to whom the collection is being interpreted. These include difficulties with reading written material because of their age, education, learning difficulties, visual or audio impairments, or simply because the language used is not their first language, as well as difficulties with physically accessing a collection.

Secondly, there is the amount of time that the visitor is actually willing to spend having the collection interpreted to them before 'museum-fatigue' sets in. Research done at the Technology Testbed science centre in Liverpool and the Techniquest science centre in Cardiff showed that on average visitors stayed at each exhibit for only 47 seconds (Russell 1989). In this case botanic gardens have the advantage that they are larger and that just physically walking through some displays could take longer than this but, having said that, according to Statistics on Tourism And Research UK the average dwell time for gardens in the United Kingdom is 161 minutes (2hrs 41mins), which is well below the 267 minutes (4hrs 27mins) recorded for theme parks (StarUK Website 2002a).

The third problem encountered is that every visitor will have had a different set of experiences before visiting the garden and these will influence their understanding of the interpretation. For instance, each garden will have those visitors that visit only once and those that are regular visitors. Keeping both groups happy can be a challenge. Another example, with far more serious consequences, is when a person's past has given them a moral sense that is different to that of the curators or exhibit designers. One such example, given by Spalding (2002), is that of the Ghost Dance shirt. This American Indian artefact, acquired in 1892, had been displayed in Glasgow Museum where there were few emotional links between it and the visitors who viewed it as just another American Indian artefact. However, to the Indians of the Lakota Sioux tribe in South Dakota this item is sacred as it is associated with the massacre of their ancestors at Wounded Knee. Therefore their experience of viewing the item in a Scottish museum is entirely different. As a result, in 1999, the museum recognised this differing view of the Ghost Dance shirt and returned it to the Lakota Sioux.

Of these three problem areas the first, access problems, can largely be addressed by label and garden design whilst the other two, retention of information and the effect of previous experiences, have a lot more to do with how we acquire knowledge. A better understanding of how we learn will better equip one for designing and interpreting collections.

5.1.2 Education Theory

Education has always been a role of botanic gardens and museums since their conception and as fashions have changed so has the target of this education. This in turn has influenced their designs. For example, Linnaeus's garden at the University of Uppsala in Sweden, a garden of the taxonomic era, was divided into formal beds with the plants arranged in accordance with his own 'sexual system' in order to make the learning of the system easier (Fara 2003) and, whilst Alfred Waterhouse was responsible for the architecture of the National History Museum in London, the arrangement of the galleries was based on designs by Richard Owen. At the time of the split of the Natural History Museum from the British Museum there was a debate as to what the roles of a museum should be and how best to display the collections. Thomas Huxley, Charles Darwin's friend and supporter, thought that curators should pick only a few pieces to display to the public, keeping the rest behind the scenes for scientists to use. Owen, on the other hand, believed that the public should be able to see a wide spectrum of specimens. With this in mind he wanted to display a complete set of insects that could be found in Britain. As a way of orientating the visitor to what was on display in the museum, his design therefore incorporated a central hall with a series of enclaves. The intention was that each of these enclaves would hold an introductory exhibit to one of the galleries in the museum (Thackray & Press 2001).

From the end of the 19th century the role of education in most British museums was the least important of their activities, being ranked in 1918 by the Museum Association as of less importance than collection, preservation and research (Belcher 1991). Education was deemed to be best satisfied by "…a collection of instructive labels, each illustrated by a well-selected specimen" (Brown Goode 1891). However, in Paris in the 1930s a group of ex-Bauhaus designers created a series of exhibits that paid particular attention to visitor circulation, different themed areas and logical sequencing. These concepts influenced exhibitions such as the 1951 Festival of Britain, which in turn resulted in the Natural History Museum employing its first three-dimensional designer in 1965 (Miles *et al.* 1988). In 1969 the physicist and educator Dr. Frank Oppenheimer opened a very different type of museum in San Francisco, which would question the educational aims of museums. The Exploratorium, as it was called, was the first of a new genre of museums that were later to be termed 'science centres' (Exploratorium Website 2002). Science centres recognised that education could be conducted in a different manner and that interactive exhibits could be used to express ideas, thus removing the need for extensive collections of artefacts. It was also the practical application of the theory that first hand experience and hands-on learning can be more influential than classroom learning. This idea has been around for at least 2,500 years as the following quote, attributed to Confucius, shows "I hear and I forget. I see and I remember. I do and I understand", although this had been confirmed more recently (Piaget 1977, Wendling 1989). Science centres, once a break away group, now influence the way museums display their collections. For example, the Launch Pad at the Science Museum, London, and its equivalent, the Discovery Zone, next door at the Natural History Museum are both hands-on galleries that have been built in response to the popularity of science centres. This trend has been taken onboard by botanic gardens in America such as the children's garden at Brooklyn Botanic Garden or Michigan State University's 4-H Children's Garden.

In 1978, almost ten years after the opening of the Exploratorium, Kimche observed that very little research had been done into the educational effectiveness of science centre exhibits and "…although no conclusive data exist, it can be deduced from available research that exhibits can be considered an educational medium, but that new evaluation models must be developed" (Kimche 1978). Thirteen years after Kimche, Quin (1991) also states that little research work has been done but is less optimistic of the direct effectiveness of science centre exhibits "…there is a general consensus…that exhibits on their own are not good at teaching. They are about inspiration. And interest, once aroused, must be taken advantage of - by schools, and through all the activities other than exhibits developed by

museums and science centres." This view is supported by Stephen Jay Gould (1991) who believes that an argument can be made for the dumbing-down and hyping-up of science in order to attract otherwise un-reached audiences only if once hooked there is an equally accessible supply of less hyped information for those who wish to take their understanding further.

Although there may be a lack of research into the effectiveness of science centres, when it comes to education in general a great deal has been done, a lot of it focussing on learning in children. Some of this can be applied to botanic gardens.

The Swiss biologist and psychologist Jean Piaget (1896-1980) developed a model of child development and learning that was very popular during the 1960s and 70s. The Piagetian model categorises the cognitive development of children in to four stages; sensorimotor stage (Infancy), pre-operational stage (Toddler and Early Childhood), concrete operational stage (Elementary and early adolescence) and the formal operational stage (Piaget 1929). In each of these stages a child will have a different understanding of the world and differing abilities to think logically. These stages are similar to Plato's four stages of development (Eikasia, Pistis, Dianoia and Noesis) (Egan 1984). Mintzes, Trowbridge, Arnaudin and Wandersee (1991) give the following example of how the Piagetian model applies to a child's understanding of what it is to be living.

Age 3-7	-	Anything that exhibits activity (movement, noise etc.) is alive
Age 7-8	-	Only things that move are alive
Age 9-11	-	Only things with spontaneous movement are considered to be living
Age12+	-	Life limited to plants and animals

(Adapted from Mintzes *et al.* 1991)

It is unclear how much of this is caused by physiological aspects of development. For instance, Preece (1984) notes that children are reluctant to change their preconceptions of science and that their ideas often "recapitulate historically earlier ideas". He proposes that this may be because we are born with these ideas or the perception that leads to these views as opposed to forming ideas on a blank canvas. However there is controversy over the location of the border between triggered (innate) and learned (constructed) concepts.

Whatever the underlying cause, be it physiological, environmental or a combination, by the 1980s Piaget's work, particularly the view that knowledge is constructed by humans from previous knowledge and experience through interactions with the environment, was being used as the basis for constructivism, a new educational model (Padilla 1991). Constructivist theory says that children will "actively construct meanings" using the information they have (Mintzes *et al.* 1991) and that the meanings that they construct, their 'conceptual framework', may differ from that supported by the scientific community, the 'alternative framework' (Duit 1991).

Therefore educators must act as agents of conceptual change. Highlighting where the pupils conceptual framework differs from an alternative framework and helping them to change theirs to match. To do this, Mintzes *et al.* (1991) suggest a process is used whereby the pupils are given hands-on experiences to engage them, and then asked to explain their models of what is happening. To facilitate this process

of establishing how a pupil's framework is constructed Trowbridge and Wandersee (1997) have provide a number of graphic organizers, including concept mapping. Mintzes *et al.* (1991) also point out that a good knowledge of the history of science helps as it can reassure students that their concept of the problem, although incorrect, has been considered by scientists in the past. It should be noted that there is evidence to suggest that some students, who are unwilling to change their personal model, can compartmentalise those theories taught in class and their own. This can be overcome if the new model is shown to work in the real world as well as in the classroom (Glynn, Yeany & Britton 1991).

It can be seen from this that the constructivist model for teaching is Socratic, that is to say that there is dialogue between pupil and teacher with the teacher constantly questioning the student, forcing them to create conceptual frameworks. In 2001 Rose, Moore, VanLehn & Allbritton conducted a comparative evaluation of Socratic versus didactic tutoring, which confirmed the previous findings of Collins & Stevens (1982) that the students tutored under the Socratic condition learned more than those under the didactic condition. They also noted that both the tutors and the students found the Socratic treatment frustrating. This was caused when the tutor continued to ask students specific questions when they lacked the appropriate knowledge to respond.

So far this section has concentrated on how children learn and understand concepts but this is only part of a complex process. Glynn, Yeany & Britton (1991) present a model for the way humans process cognitive information, which consists of three areas-

Working Memory	–	An area of small capacity where cognitive operations are performed
Long-term Memory	–	Area where the products of learning such as facts, figures and mental models are stored
Executive control	–	The part responsible for linking the other two parts. Extracts facts from the long-term memory, supervises the work in the working memory and the files the results back in long-term memory

Most of what has been discussed so far has concerned the processes that occur in the working memory and the executive control because although a misconstrued framework may be stored in long-term memory it is the other two areas that are responsible for the misconception. However, as one matures the remembrance of all the components of a theory or argument can become more of a challenge. This has been a common problem for centuries and one for which the Greek orators developed a technique of rhetoric, the method of loci, by which they could remember and deliver long speeches. This technique works by associating objects (imagines) that represent parts of the speech with places on a path through a well-known space (loci). There were even well defined rules as to what makes a suitable location for this technique as shown below.

> The loci should be deserted, as people are distracting.
> The loci should not be too similar.
> They should not be too big, or the imagines will be lost, and if the loci are too small they will be crowded.
> The colours of the loci should not be too bright.
> The distance between the loci should be approximately 9m.
>
> (Adapted from Yates 1966)

This technique is still in use today and is the method by which Andi Bell, the 2002 world memory champion, can remember the order of 520 playing cards (10 shuffled packs) (BBC Website 2004). In Europe, during the 16th century, the collection and arrangement of natural and man-made artefacts into 'cabinets of curiosity' was a popular pastime among the richer classes. In the past it has been assumed that these collections were arranged arbitrarily. However, Hooper-Greenhill (1992) believes that a similar technique to the method of loci was used so that by memorising the location of the objects in the cabinet the owner would be able to remember how they all relate to each other as with Linnaeus's garden in Uppsala.

One educational approach that is specific to teaching about plants is Earth Education (EE). This evolved from the Environmental Education movement in America during the 1960s and was developed initially as seven-week long programmes for use at residential 'summer camps'. Van Matre, the originator of Earth Education, believes that its predecessor, the Environmental Education movement, failed for the following seven reasons.

1. Objective defined to broadly.
2. Promoted an infusion approach rather than a focused educational programme.
3. Used short-term issue based projects rather than long-term lifestyle decisions.
4. Accepted sponsorship from agencies and industries that helped create the problems in the first place.
5. Neglected to distinguish itself from other outdoor experiences.
6. Gave no guidance as to why some ecological concepts may be more important to convey than others.
7. Did not generate a model to aspire too.

(Van Matre 1999)

To address these failings van Matre developed Earth Education, which consists of three components, expressed as questions-

> How does life work?
> What does that mean for you?
> How can you begin changing your lifestyle in order to live more lightly on the earth?
>
> (Van Matre 1999)

EE differs from other movements by having lifestyle change as a desired outcome rather than just understanding. This is achieved through 'learning programs' – focused series of sequential, cumulative experiences designed with specific outcomes in mind. These are composed of three elements; hookers, organisers and immersers.

Hooker – "…is the thing that pulls the learners in and motivates them to work on what you want them to learn" (Van Matre 1999)

Organiser – "…is the thing that helps the learners keep track of what is happening to them in the program. It is a device that provides some logical way of holding on to the various parts of the experience, and…serves as an accessing tool for the learners in the future." (Van Matre 1999)

Immerser – "…is a technique or activity that gets our participants over those common barriers that most people have erected between themselves and the natural world… The immerser is an intense, perception-changing experience." (Van Matre 1999)

Although the EE framework was initially devised for the creation of residential programmes operating over a long period it can also be used as the basis of shorter programmes lasting as little as 45-minutes (Randle 1991). These short duration activities are more applicable to a botanical garden environment where contact with a visitor is usually limited to only a few hours.

5.1.3 Communication Media

Educational theories deal with how information is processed and stored but in-order for this to occur that information must first be 'inputted' into the brain. Humans have five senses with which to gather information about the environment and which can be used as media for communication. The examples below show how interpreters have tried, with varying degrees of success, to appeal to these senses in an attempt to convey a message.

5.1.3.1 Smell

Smells can be very evocative and a number of attempts have been made at using them in interpretation. For example, the designers of the Jorvic Viking centre (York) have tried to increase the realism of the experience for the visitor by replicating the smells of Viking York in their mock-up of the village. However, it is notoriously difficult to control smells and if more than one is used they can become mixed or drift into parts of a display where their presence may be confusing. Add to this the fact that not everyone's sense of smell is the same, which could lead to misinterpretation, and the sense of smell, by itself, is seen to be a rather crude tool for interpretation.

5.1.3.2 Taste

The sense of taste is very closely linked with the sense of smell, which is why children are told to pinch their noses when swallowing medicine. Whilst the delivery of a taste at a specific point of a display can be more precise, there are additional health and safety issues concerning the handing, storage and distribution of material that is for public consumption that are not encountered with smells. Like smell, a lack of a universal language of taste means that complex ideas cannot be communicated with it, instead it can be used to add to visitor experience. A number of botanic gardens have handed out foods at particular points to augment the interpretation of a display.

5.1.3.3 Touch

Once visitors were deprived of tactile interaction with specimens but in museums at least, this is changing. Although there is still a need to prohibit the touching of a lot of the collections in order to protect them, or the visitor in the case of zoos, many museums now provide spare or replica material that can be touched. In botanic gardens there is a greater problem in finding plants that can be touched without harm to them or the visitor. At the Eden Project touching plants is not visually

discouraged with signs etc. although the size and layout of the beds does allow delicate plants to be grown out of reach. Where regular touching by visitors has altered the shape of plants, such as the lavender (*Lavendula spp.*) display in the warm temperate biome, this is used positively by bringing it to the publics attention and explaining how the plants change in form is a protective response to grazing. A slightly different use of touch in interpretation can be found in the Evolution House at the Royal Botanic Gardens, Kew, where the visitor's experience of walking through a carboniferous coal swamp is enhanced by the use of a spongy rubber floor that simulates boggy conditions. With the exception perhaps of Braille, touch by itself cannot be used to convey detailed ideas. Whilst touching an object may not convey a huge amount of additional information, it does seem to help visitors establish an important link with that object and it is an instinctive urge to want to touch an object being encountered for the first time, even if we know we are not meant to.

The last two senses, sight and sound, are the most important and commonly used for interpretation. Through a combination of the two we get the majority of our information and it is with these that we conduct the majority of our communication, as they are the two media with which we use language (spoken and written). However, language is not the only way that these media can be used.

5.1.3.4 Sight

We are constantly using our sight and therefore processing the data it generates. Visual representation can therefore be used at a series of different levels to inform the visitor. As has already been mentioned, sight can be used to communicate language through the medium of writing and like the previous senses can be subject to misinterpretation. There has been a great deal of work published on the best ways of using text and these will be reviewed in the following section. In addition to text, symbols can also be used to. For instance the Eden Project has been experimenting with software for creating signs using Widget Rebus Symbols (Craddock 2004 pers. comm.). The Widget Company works with many organisations advocating the use of symbols as a tool for communicating with people who have learning disabilities (Widget Website 2004). Symbols and text convey an idea or event but sometimes it is possible to show the event itself. For instance the pollination method of an orchid could be described with text but, with the aid of a slow motion film, could be shown for real.

5.1.3.5 Sound

As with sight, sound can be used at a number of different levels. Firstly, there is the use of sound to convey language through the spoken word. This can be either as passive media such as a lecture or recording where there is little interaction between the speaker and the listener, or an interactive medium where there is a dialogue between the listener and the speaker, such as a conversation or some guided tours. Sound can also be used to influence how people feel, something that has been well known by filmmakers for a long time but has also been used in exhibit design. For example, the Jorvic Viking Centre (York) uses the sounds of a busy street to add atmosphere to their display. Similarly, in the Evolution House at the Royal Botanic Gardens, Kew, sounds suggestive of gigantic carboniferous insects help differentiate this display from that of the other glasshouse displays in the garden. Sounds are also subject to the misinterpretation due to differing previous experiences. For instance, to a lot of people the sound of 'Air on a G-string' by Bach would instantly be associated with Hamlet cigars, or 'O Fortuna' from Orff's Carmina Burana with Old Spice aftershave, and these associations could be built into an exhibit. However, these associations would not be made by people who are not familiar with British television prior to 1999 when the advertisements using these pieces were last shown (Commercial Breaks and Beats Website 2004).

5.1.3.6 Frame of Mind

The previous sections have dealt with various methods of communicating. However, for this communication to be successful the recipient must be receptive.

Abraham Maslow (1948) postulated a 'hierarchy of needs', which has been used in many situations, such as marketing (Blech & Blech 1999) to model human motivation. The hierarchy, shown below in Figure 5.1, consists of a pyramid with five levels. The theory is that starting at the base with physiological needs, such as food and water, humans must satisfy their needs in this level before they are concerned with those in the levels above. At the top of the pyramid is the self-actualisation level in-which learning and self-development occur. This suggests that learning environment must provide everything needed to satisfy the lower levels in order to be successful. For example-

Maslow Level	Satisfying Action
Physiological	Provide food, water and toilets
Safety	Provide an environment that feels secure
Social	Do not alienate visitors with displays that may be offensive to their race or personal history.
Esteem	This is slightly harder to identify and provide for but for instance, removing or playing down Latin names and rewriting long technical descriptions will help reassure the visitor that they are capable of getting something from the visit.

Once the basic needs have been met the visitor should be at a level where learning is likely to occur. However, research by Csikszentmihalyi and Robinson (1975) has shown that students must be in the correct 'frame of mind' in order for learning to occur as efficiently as possible. The diagram below (Figure 5.2) shows that the authors perceived a region that falls between states of anxiety, caused by over or under stimulation, in which play, learning and creativity are at an optimum. It is therefore important, if exhibits are to be effective, for the visitor to be kept in this flow band where they are being challenged enough to prevent boredom but not so much that they then become anxious. The design of the interpretation media can help achieve this.

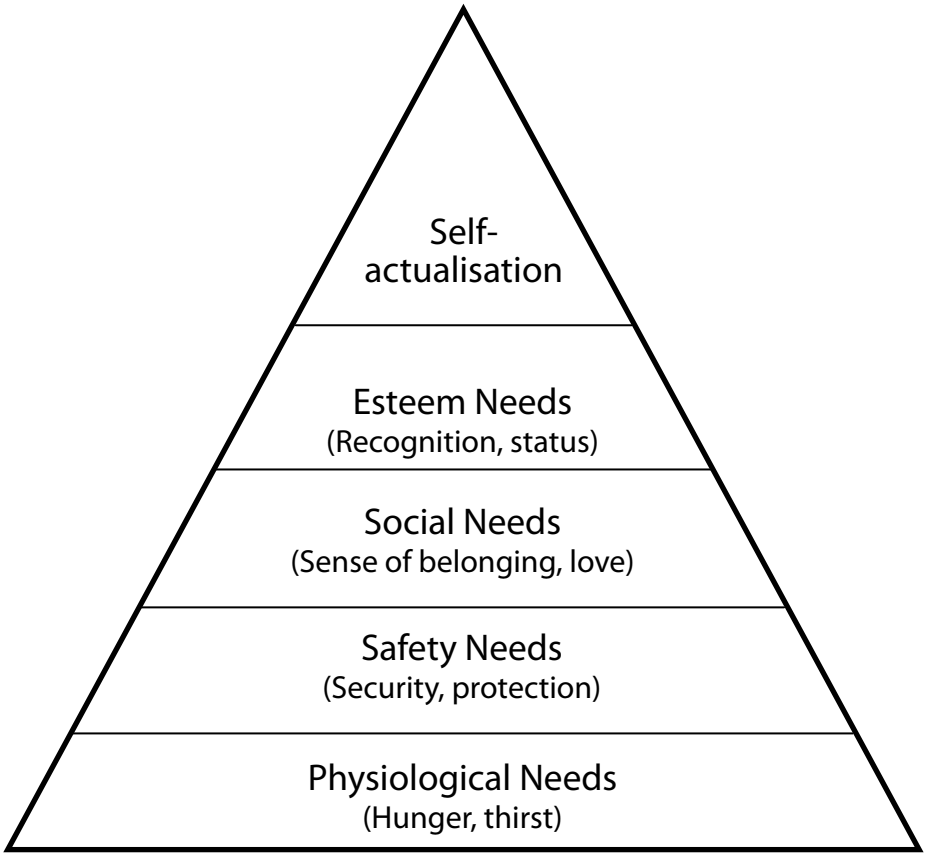

Figure 5.1 - Maslow's Hierarchy of Needs adapted from Blech & Blech 1999

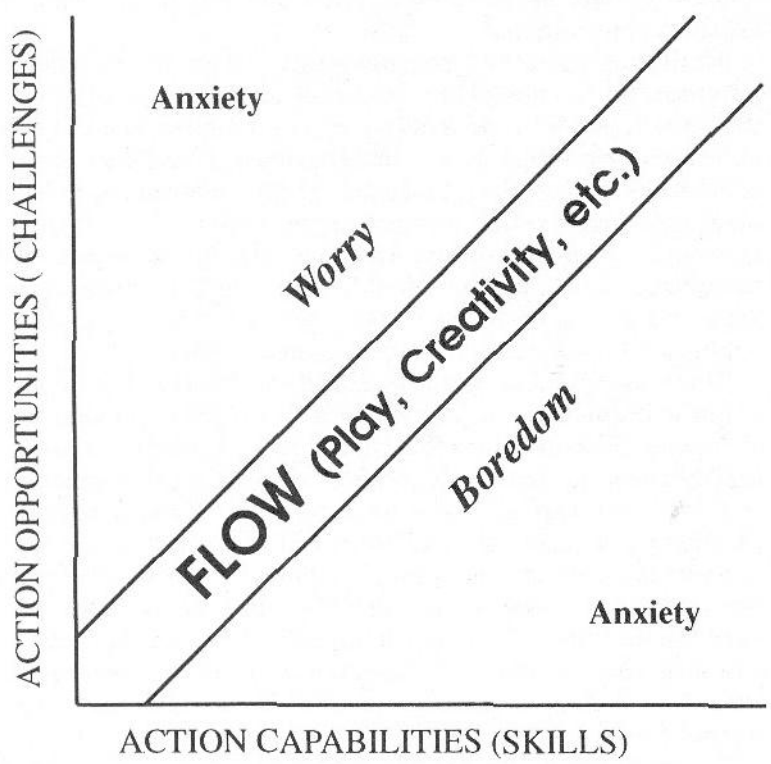

Figure 5.2 - Boredom anxiety model Csikszentmihalyi & Robinson (1975) as given in Yahya (1996)

5.1.4 Interpretation Media

Interpretation has two different roles in a botanic garden; one is to orientate the visitor, whilst the other is to impart information to the visitor.

Orientation – Ransley (1992) differentiates between physical and conceptual orientation. The first involves the visitor's position in the garden and the location of facilities etc. The second is the introduction of the visitor to the "interpretive themes, institutional goals and organizational strategies" (Ransley 1992). Although maps and signposts with words are the most obvious solutions there are alternatives. For instance, the car park at the Eden Project is divided into several similar levels. Rather than numbering the different levels each level has labelled with a different fruit to help aid memory. This means that visitors, who may well have forgotten the number after a day on site, have an increased chance of finding their car because either the colour or the name of the fruit can remembered. By using signs that comprise of just images confusion due to language barriers is avoided.

Informative Interpretation – From the results of the survey of botanical collections in Britain, described in detail in chapter 2, it can be seen that of the top five most frequently used methods of interpretation four of them rely solely on the written word (Plant labels, information leaflets, display boards and guidebooks). In the following sections the various methods of informative interpretation will be examined including text, guides, audio tours, video, mixed digital media, websites and art, sculpture and performance.

5.1.4.1 Text

Screven (1992) states that, in the past, one of the major reasons given by visitors for not visiting museums was "…the difficulty they encounter in finding out why specific objects are there, why they are important, or their connections to the visitor's world." In response to this realisation many museums have started to give a lot more thought to how they label their exhibits. This is probably why Ehrlinger (1986) believes that botanic gardens should now be looking to museums for guidance on their own labelling. He describes how museums frequently use a tiered approach to labelling their exhibits, which he divides into the following categories-

Title Labels	–	large, colourful and often accompanied by graphics these labels are used to attract visit interest.
Introductory Label	–	large and usually containing graphics as well as 50-200 words the purpose of these labels is to introduce the visitor to the theme of that exhibit.
Group Labels	–	these labels fall between introductory labels and caption labels in size, they will contain 25-100 words and may have graphics. The purpose of these labels is to compare groups of similar objects such as plants
Caption Labels	–	the smallest of the labels, they contain less than 40 words and are used to give specific information about an object.

(Adapted from Ehrlinger 1986)

Miles *et al*. (1988) describe a similar tiered method; they suggest "a treatment at not less than two, possibly three or even more layers of resolution." The lowest level (level 1) contains the minimum of concepts required to understand the topic. Level 3 takes the visitor to the "frontiers of knowledge" and level 2 acts as a bridge between levels 1 and 3 or just as an expansion of a level 1 concept where no level 3 concepts is to be given. Trapp, Gross & Zimmerman (1994) suggest the use of what they call a 3-30-3 message pyramid. This is a tiered approach to interpretation that is analogous to the way newspaper articles are written. It offers the reader three message options where the topic is described in a 3-second piece, a 30-second piece and finally a 3-minute piece. This gives the reader an option as to what depth they wish to pursue that topic.

Jo Readman, Head of Education at the Eden Project, describes how Eden's interpretation tries to operate on what she calls the "Simpson's Principle" (Readman 2002 pers. comm.). This is named after the popular American cartoon series of the same name, which crafts its cartoons in such a way so as to include a mixture of different types of jokes such as slapstick, political satire and comical references to films. This diversity of comic content means that the show appeals to a range of different types and ages of people, at a number of levels. Thus Eden hopes that by having an equal diversity of interpretation content they will be able to interest a wide range of visitors.

When it comes to actually writing the text for interpretation there are results of yet more research that can be referred to for help, such as 'self referencing', the technique of referring to the individual and posing them a question. For example, "If you were in this situation…" is more effective than a more descriptive text in the third person (Ham 1992). The type of words chosen for the text combined with the complexity of the sentence structures will affect whether certain groups of visitor can easily read and comprehend its message. Sorsby & Horne (1980) studied the readability of labels from seven museums in Britain. They found that the majority of labels required a reading age of 16 or above and that none could be read by a child of less than 12 years. They deduce that three-quarters of visitors will be unable to use two-thirds of the museum labels because the vocabulary and sentence structure was too difficult. The labels are usually positioned vertically. This is not ideal (the ideal being at 45° and being read whilst seated in a comfortable chair), and this further increases the difficulty of reading a label. Taking this into account the authors recommend that no label should have a higher reading age than 15. To help writers of interpretation text ensure that their texts are comprehendible to their chosen audiences there are two tests that can be applied, the Flesch Readability Scale (Flesch 1949) and the Write Formula (Neal 1976) details of which are given below.

Flesch Readability Scale

R = 206.835 – 0.846S – 1.015W

R - The readability score
S - The number of syllables in a 100-word sample
W - The Average number of words per sentence in a 100-word sample

Score	**Results**
90-100	Very Easy
80-90	Easy
70-80	Fairly Easy
60-70	Standard
50-60	Fairly Difficult
30-50	Difficult
0-30	Very Difficult

The Write Formula
From a 100 word sample score 1 point for every one-syllable word. Score three points for every sentence in the 100-word sample. If the piece has less than 100 words multiply up to get an equivalent score. Add the two scores together.

Score	**Results**
85-100+	Children's Publication
75-85	Average American Reader
65-75	Above Average American Reader

Once a readable text has been created it must be presented in such a way that does not impede it from being read. Trapp, Gross & Zimmerman (1994) offer the following advise for successful display panel design.

- Avoid the use of cheap materials
- Avoid square panels; use instead a 5:3 or 5:4 ratio that is more visually appealing
- Avoid highly reflective materials
- Bold materials and designs of a sign give it importance
- Dark lettering on a light background is more easily read in shaded conditions.
- Light lettering on a dark background is more easily read in light conditions. [Most botanic gardens in Britain now use labels that have white text on a black background.]
- Establish a visual pathway around a sign using graphics, start with a strong focal point
- Use a minimum of capital letters

(Adapted from Trapp *et al.* 1994)

The further away the reader is from a panel the larger the text has to be for it to be read comfortably. In the same text Trapp *et al.* give the following variations in text size for reading at different distances.

Text Vertical Measurement	Viewing Distance
1.3cm (½")	1.2m (4')
1.6cm ($^5/_8$")	1.8m (6')
6.4cm (2 ½")	9.1m (30')
10.2cm (4")	18.3m (60')

Table 5.1 – Relationship between text size and viewing distance as given by Trapp *et al.* 1994

Velarde (1988) adds to this that the further away a text is to be read from the greater the gap between letters should be and the shorter the line length (For exhibition text, Spencer & Reynolds (1977) recommend that lines are no longer than 50 characters). In addition to this serif text should be used for text that is going to be read close up, e.g. books etc., while for text that is to be read from a distance, e.g. posters and large signs, a sans serif typeface should be used. All information should be displayed between 900mm and 2000mm from the ground, this being the visual band of an adult standing (Velarde 1988).

Finance of labelling

Labels in botanic gardens can take many different forms but all of them must be able to resist being constantly exposed to adverse weather without fading, rotting, rusting or becoming brittle. They must be attractive enough to draw the attention of the public but not so attractive that they want to take them home with them, or attached well enough so they cannot. Unfortunately, finding labelling solutions that meet all these criteria is usually not cheap. For example, Katie Steel of the Interpretation Unit at the Royal Botanic Gardens, Kew, points out that the fibreglass signs, which faded quite quickly, cost £90 per A3 sign. The new digitally printed signs that Kew has started using, and which should be more durable, are costing approximately £200 for the same size sign (Steel, K. 2002 pers. comm.). At these prices, even in a small garden, the costs can still mount. The cost of producing the familiar white on black botanic plant label is one of the major contributing factors for Kew's decision to change from these to using stamped aluminium tags. A 75mm x 100mm (3" x 4") white on black label engraved with the information normally found on botanic garden label costs £2.22 from Sheen Botanical Labels Ltd, a frequently used supplier (Ashton-Jones 2004 pers. comm.). The Royal Botanic Gardens, Kew, have approximately 30,000 species in the collections and therefore it would cost in the order of £66,600 to purchase one of these labels for each species. In reality, there are probably far more labels in use in the garden and each label has a finite life so this cost is recurring. However, as can be seen in the photograph below (Photograph 5.1) the writing on the aluminium tags is not differentiated from the background and as result they are unreadable from any significant distance, which may result in an increase in visitors treading on beds to read them. If they have not already, Kew will probably receive complaints as they phase out the traditional white on black labels. A balance must be struck between the cost of interpretation and its value to visitor. When the Eden Project first opened there was a conscious effort not to have as many labels as other botanical gardens. However, following feedback from the public, who wanted them, more have been added. This would have been a significant cost so Eden sought other ways of providing signage. One solution that they developed was hand-painting text onto various objects.

Photograph 5.1 – Embossed aluminium labels used at the Royal Botanic Gardens, Kew
(Source: Royal Botanic Gardens, Kew (2004b))

5.1.4.2 Guides

In 1912 the Natural History Museum in London appointed John Leonard as the first guide-lecturer (Thackray & Press 2001). A year later, in 1913, following the success of the Natural History Museum scheme, a guide-lecturer (Mr. S.T. Dunn) was trialled at Kew. A combination of lack of support from the Director, Sir David Prain, who had argued against having guides, and lack of public support, probably due to the high charges for the tours, which resulted from the gardens need to generate income, meant that the trial was abandoned in 1920 (Desmond 1995). It was not until forty years later, in 1960, that public education at Kew came under scrutiny; this resulted in the reorganisation and labelling of the museum collections as well as reinstating the guide-lecturer scheme (Desmond 1995).

Amongst British botanical collections, guides are presently the second most frequently used method of interpreting a collection, being used by 93% of collections. Approximately 51% of British botanical collections use volunteers to do their guiding. Guided tours are seen to be better than other interpretative methods (Hyland 1986), probably because it is the only interpretive method where there is an active communication between the botanic garden and its visitors, which means that misunderstandings can be corrected and the information provided can, in theory, be tailored to suit the age and interests of the audience (the benefits of Socratic education techniques over didactic have already been discussed in the education theory section). This flexibility allows guides to adapt tours not only for the intellectual abilities of the visitor but also their physical condition. For example, Cambridge University Botanic Garden offer guides who have been trained in visual awareness and sighted guiding techniques to facilitate visually impaired visitors (Upson 2004 pers. comm.) There can, however, be several problems encountered when setting up and maintaining guided interpretation most of which centre on the fact that humans are involved.

All guides need two skills; the first is to know and understand the information that they are meant to be imparting, and the second is that they must have the ability to communicate it in an accurate, efficient and interesting way. Both these skills can be improved with training but humans are always fallible, as Mark Paterson, who runs the guide team at the Eden Project, summarises "You can't control what goes on in their [the guides] minds. Unlike display boards they can off days." (Paterson 2002 pers. comm.). There are two different ways that a team of guides can be trained and managed. The first is to use a tightly controlled script, which every guide must learn and then use when taking tours. This method, used by the volunteer guide team at the Royal Botanic Gardens, Kew, is good because it sets a testable level of knowledge that can be used to maintain quality. It also speeds up the process of training. The second method, used by the Eden Project, is to have a testable level of knowledge but in addition to this to encourage guides to expand this knowledge in to areas that interested them. This results in a system that is more difficult to manage but that has the ability to evolve to include topical issues of the day. As well as this, because each guide adapts the content of their tours and the style of delivery, taking a tour will be a different experience depending on who the guide is.

5.1.4.3 Audio Tours

Audio interpretation can take two forms. The first is the static unit type where a recorded message is played either when a handset is lifted, as can be found in many museums, or when a proximity detector is triggered, good examples of this would be the introductory talk in the Evolution House at Kew, where the unit is hidden, or the solar powered information points dotted around the Earth Centre near Doncaster. The static nature of these units means that they will be used to play one message. Trapp, Gross & Zimmerman (1994) recommend the following points when designing audio messages.

- Keep it short (3mins is more than enough)
- The production should sound live.
- Use the first and second person
- Pre-test the script
- Use sound effects
- Digital sound equipment ensures durability

Work by George Miller (1956) on the human capacity for processing information suggests that, depending on how this is measured, the maximum number of points humans are capable of receiving in a talk is between five and seven. During research for this thesis it has been observed that if the period between the lifting of the handset and the start of the message is to long many visitors will move on to another exhibit. However it is also annoying if the message starts before the visitor is ready. To solve this problem the recording could start playing introductory music before commencing with the actual message, thus demonstrating that it is working but allowing visitors time to get ready to listen to the message.

The second form of audio interpretation is the mobile audio unit. Most people will be familiar with the audio tour 'wands' with which many museums deliver their audio tours. The majority of these are from Acoustiguide, an American company, whose business is installing and running audio tours for museums, science centres, historic sites etc. around the world. So far the Acousitguide company has installed audio tours in the New York Botanical Garden (USA), Stichting Schovenhorst Botanic Garden (Netherlands) and the Beijing Botanical Garden (Peoples Republic of China). As well as the traditional wands they now also offer a smaller headset version. These units are basically MP3 players that use solid state memory with the capacity of playing nine hours of full production material (or up to 54hours of lower quality recordings) (Acoustiguide Website 2004). The large memory contained in these units, in excess of that which could actually be listened to during a single visit, allows the units to offer additional features. Each unit can have up to 8,000 different messages each accessed by the keying in a number on the keypad. This allows the museum to offer the tours in a selection of languages, or a selection of differently themed tours and it means that visitors can have the option to explore areas of an exhibit that interest them in more detail. For example, if there were an audio tour that included a message discussing the Cinchona tree, the visitor, at the end of the message, may be given the option to find out more about the process of quinine extraction, hear about famous people killed by malaria or cured by quinine or to continue with a tour of medicinal plants.

The Royal Horticultural Society (RHS), at its garden at Wisley, Surrey, is one of the first botanical gardens in Britain to offer audio tours. The tour consists of a total of 50 stops on two routes, each of which takes about 45 minutes. They have elected to use celebrities to do the narration, with the introduction given by Roy Lancaster and two hours of commentary by Pippa Greenwood. The units can be hired for £3.50 each plus a £5 deposit (RHS 2003).

The cost of setting up an audio tour is probably the main reason why many gardens have not chosen to do this yet. Unlike some other forms of interpretation, which can be can be introduced slowly into a garden or trialled with short publishing runs, an audio tour can only be offered in its completed form, although there may well be the opportunity to trial it on a smaller area if the garden has a stand alone exhibit that would be suitable. There are three main areas of cost involved with audio tours. The first is the outlay for the hardware. The second is the cost of tour design, script writing, narration, editing etc. The third is the cost of employing staff to handout and maintain the units. Acoustiguide offer various different packages to suit the various needs of the organisations whereby you buy or hire the equipment and even have their staff onsite to manage distribution of the units to the public. As with the RHS at Wisley, many organisations cover the costs by offering the audio tour as an additional service for which the visitor will have to pay.

5.1.4.4 Video

Serrell (2002) analysed the attraction rate and holding power of a number of video presentations. He found that the average attraction rate was 32%, meaning that one third of visitors was enticed into watching the video. This clearly suggests that videos are not an efficient way of introducing material and concepts that are not available through other media. The results also showed that the average holding time was 137 seconds (2mins 13secs) and 75% of videos surveyed had holding times of under 2.5mins, thus emphasising that, unless there are extenuating circumstances, there is no point in creating a video longer than 2.5mins because it will not get watched all the way through.

Serrell's research work also indicated that placing a video at the start of an exhibit can be seen by the visitor as a hold-up to viewing the rest of the exhibit and thus be avoided. Alternatively, placing it at the end of the exhibit may well increase the likelihood of it being viewed because it will be seen as a good opportunity to take a break.

Thomas (1986) describes videos as being "easy to run and maintain but are almost useless for orientation because they are inflexible and unchanging". In contrast, a slide show offers greater flexibility, although from experience they can be temperamental to maintain, something that Thomas (1986) confirms with the figures he gives for the slide show at Longwood Gardens, USA, which annually costs $4,500 for new projectors, $2,000 for maintenance and at least an hour each day of technician time. This excludes the costs of script writing, photography and narration.

The biggest problem with these types of presentation is that invariably visitors will miss the start and thus miss out on part of the orientation. If this is to be avoided a careful balance must be struck between having a short running time and delivering all the relevant information at a pace at which the visitor can absorb it.

The Royal Botanic Gardens, Kew, have a five-minute video that describes why Kew exists and what it does, i.e. it explains Kew's mission statement. The video plays at the visitor centre at Victoria Gate (the primary entrance used by the public), the screens are cleverly located in an open plan café area where people stopping for refreshment on arrival or departure will be highly likely to watch the video, in its entirety, whilst they have their cup of tea etc. The static nature of the audience means that the video, which is longer than would normally be recommended (5mins in total) is more likely to be watched.

5.1.4.5 Mixed Digital Media

With the rapid advances that are being made with digital media and electronic hardware, more and more alternative methods of delivering interpretation are becoming available. Computers have been used for a number of years in museums but the faster processing speeds and the ability to network

etc. means that the quality and speed of the programmes that can be used on them has dramatically improved. There have been several studies into the effectiveness of computers to assist learning in the classroom (Yalcinap, Ozkan & Geban 1995, Hudson & Soyibo 2000), which have shown that it is beneficial. We are now reaching a stage where computers are capable of delivering such a large range of media, e.g. slide shows, spoken word, written material, interactive educational games and video footage, that the lines between the media are becoming blurred.

There are three ways that digital media can be applied in botanic garden interpretation. The first is by providing computer terminals, perhaps in the form of touch screen stations within the garden. The second is to provide people before and after their visit with a digital media resource available through the Internet. The third way is a hybrid of these two, the provision of a mobile access to the media whilst on site. This could either be through technology that they already possess, such as mobile phones, or by providing them with the hardware, as with an audio tour (Appendix 3 contains an outline of how such a system might work and how it could be used as a collection management tool as well as a for interpretation). As these technologies are still emerging it may not presently be financially feasible for gardens to develop prototype systems. Instead they may need to wait for a company such as Acoustiguide to do the product development and then employ them to install and run the system. In addition to the cost of hardware development there is also the cost of data input, i.e. adding information about the plants held. For an established organisation this would be a daunting and expensive exercise. However, if with a new botanical collection the system were incorporated from the outset the data inputting could be done at the same time as plants were introduced to the garden and thus it would grow as the collection grew.

In the meantime, the technology and technical skills required to set up and maintain a Website are easily available and, depending on the size and style of the Website, relatively cheap. However, the survey of British botanical collection websites (see below for more details) showed that 40% of collections did not have a Website and of those that do, and that have education as an aim, less than 20% use the Website for education purposes.

5.1.4.6 Websites

There is little written on the use of websites by British botanical collections as media for delivering their missions. The survey described below investigates whether the 64 botanic collections that returned data to the original botanical collections survey (see Chapter 2) have websites and if so what they are using them for.

Method

The search engine 'Google' (www.google.co.uk) was used to perform a search on the names of each of the 64 botanic collections that returned data to the original botanical collections survey. Google was chosen because it is general accepted as being one of the most thorough search engines. The search was performed on the name of the collection as given by the respondent on their returned survey forms. The pages returned by Google were then examined to try and find a page managed by that organisation, rather than ones just discussing that collection (for instance there are a lot of organisations that list and describe gardens that are open to the public).

When a suitable page was found it was then analysed to assess which of the following features it had.

Visiting Information	-	Did the Website give details of how to get to the garden, price of entry and times of opening?
Historical Information	-	Was there any discussion of the history of the collection?
Events Information	-	Were up-coming events listed?
Contact Information	-	Was an address, telephone number or e-mail address given?
On-line Tour	-	Did the site include a pictures and descriptions of the key aspects of the garden?
B&B Information	-	Was any information given of places to stay when visiting the garden?
E-mail Notification	-	Did the Website allow the visitor to leave their e-mail address so they could be informed of events/ news in the future?
Information about Research	-	Was there any discussion of the research carried out with the collection?
Information about Conservation	-	Was there any discussion of the conservation work conducted using the collection?
Enquiries Service	-	Did the organisation use their Website to advertise an enquiries service? This differs from just supplying contact information, by the organisation stating that they offer a service, such as plant identification, and providing details of how it can be used.
Database Information	-	Does the organisation provide information about the plants in their collection, or plants in general, in the form of a searchable database or a list?
Education Page	-	Within the organisations Website is there an area dedicated to education? (Note – pages that just had information on the courses offered were not counted.)
Links	-	Were there links to any other sites given?

Results

Of the 64 gardens searched for on the Internet 38 (60%) had their own websites. Analysis of their content gave the following results.

	No.	% of the 35 Gardens with Websites	% of All 64 Gardens Searched For
Visiting Information	32	84.2	50.0
Contact Information	31	81.6	48.4
Historical Information	26	68.4	40.6
Events Information	25	65.8	39.1
On-line Tour	21	55.3	32.8
Database Access	11	28.9	17.2
Links	11	28.9	17.2
Information about Research	6	15.8	9.4
Information about Conservation	6	15.8	9.4
Education Page	6	15.8	9.4
B&B Information	3	7.9	4.7
E-mail Notification	3	7.9	4.7
Enquiries Service	2	5.3	3.1

Table 5.2 – Results of analysis of the 38 collections with Websites

It can be seen from these results that at present the main purpose of garden websites would appear to be promoting the garden and facilitating visits. The possible use of these websites as a media for disseminating additional information or educating visitors is only utilised by a few gardens. The notable exceptions are the Royal Botanic Gardens of Edinburgh and Kew who both you use their websites to offer access to various databases of plant based information.

The percentages given in Table 5.3 above are a representation of the number of websites with that as a feature given as a percentage of all the found websites. Whilst this gives an accurate result for features such as visitor information, which are universal in their relevance, some topics such as research, education and conservation information are only applicable to those gardens that include them within their roles. Using the results gained from the survey of botanical collections the data can be reworked to give the percentages for each of these features as a percentage of those collections that have these as their roles. The results show that websites are far less likely to be used for education than the discussion of the research or conservation work being done in the gardens and that between 45%-80% of gardens are not using a homepage to convey information about the roles of their collections.

	No. of gardens with this as a role	No. of garden websites that cover these topics	No. of websites as a % of the gardens that see this as one of their roles
Education	33	6	18.18
Conservation	19	6	31.58
Research	11	6	54.55

Table 5.3 – Number of collections using their Website to provide information on education, conservation or research expressed as a percentage of those collections that have these as their roles

Possible Errors
A certain degree of skill is required in setting up a website so that it gets a prominent listing on search engines such as Google. It is therefore plausible that some of the gardens have websites but that they were not returned by the Google search. It is also plausible that the garden runs an educational page that is not accessible from the public homepage, thus requiring the school to have visited in order to make use of the resource. These would not have been found by a manual search of the website and therefore would not have been recorded.

Websites will never replace a visit to a botanic garden or museum but they do present these organisations with an opportunity to offer an alternative experience linked with their collections. The truly global nature of the Internet means that these web-experiences will be accessible to many more people than the actual collection. This is born out by *The Natural History Museum Annual Report 2002/03* (The Natural History Museum Website 2004), which shows that during that financial year there were 2.9-million visits to the museum's sites at South Kensington and Tring, while the museum's website received 4.7-million visits in the same period.

5.1.4.7 Performance
Performance straddles the boundary between interpretation and design described in the introduction to this chapter because in some cases it can be a direct communication similar to guides or video but in others, such as mime and aerial-ballet, it involves the visual communications of ideas. There are two different types of performance that take place in botanic gardens. The first are events put on because the garden is a suitable venue; the second are events put on as an interpretative tool.

For many years those botanic gardens that have enough space to host concerts and plays have done so. For example, in 1900 a performance of Love's Labours Lost, staged at the Royal Botanic Gardens, Kew, received good reviews (The Graphic 1900). Over a century later, Kew is still staging Shakespeare plays, this year (2004) Twelfth Night and Much Ado About Nothing, as well as hosting their annual five-day music and firework event known as 'Summer Swing' (RBG Kew Website 2004a). In 2003 Bristol University Botanic Garden hosted a 'Summer Garden Party' with jazz bands performing (BUBG Website 2004), Ness Botanic Garden also holds an annual outdoor evening concert (Ness BG Website 2004). The Eden Project puts on a series of different types of musical concerts under the title of the 'Eden Sessions'. These take place in an amphitheatre with purpose-built stage (Eden Project Website 2004a). The Birmingham Botanic Gardens has its own bandstand that is used regularly for performances (Birmingham BG Website 2004)

For many botanical gardens the predominant reason for running these events is commercial but there are other reasons. For example, Eden makes no money at all from its Eden Sessions, aiming only to break even. The event is staged to help with their other aims (Kendle 2005 pers. comm.). By providing an event for a younger adult audience they are introducing a demographic to Eden that would not usually visit a botanic garden. They are not expected to leave with any greater plant knowledge instead it is hoped that any negative preconceptions they may have had are removed and that they may return in the future for a more traditional visit (Jasper 2004 pers. comm.). (See the Eden case study for more details chapter 6).

As mentioned earlier not all performances are purely commercial. In his paper '*All the (Natural) World's a Stage: Museum Theatre as an Educational Tool*' Hawkey (2003) describes the range of theatrical events that have been used at the Natural History Museum, London to aid interpretation of the collections. His descriptions fall in to three categories; puppetry, character actors, and finally, performance art.

Puppetry
Hawkey (2003) talks about a puppet show, called 'Over the Edge', that the museum put on for adults as an additional, pay to enter, evening attraction. He notes that "puppetry offers the advantage of being able to present sensitive issues more easily and more acceptably than with live actors in a role." Puppets have a timeless quality that allows time travel in productions. Also, when characters are given names such as Jo or Sam there is an ambiguity as to the sex of the character, which avoids stereotypes and allows the role to be played by both male and female actors. Hawkey also notes that visitors, especially adults, find it easier to interact with a puppet rather than directly with an adult. As with the Eden Sessions described above, one of the aims of this production was to encourage non-typical museum visitors into the building. Informal interviews with the audiences suggested that this show had achieved this aim.

Character Actors
Character actors, having taken on the appearance and personality of an historic character, interact with visitors telling them about their life and answering their questions. Using the example of a Darwin character, Hawkey (2003) shows the importance of character design. In this case the museum decided to depict a young Darwin who has knowledge of science to date. This allowed the actor to talk to the visitors about modern discoveries such as DNA but meant that he only needed to have a limited knowledge of Darwin's life as he could always fall back of the excuse that he has only just returned from the Galapagos and is still formulating his own ideas on the subject. Hawkey points out that "positive learning outcomes can be harder to achieve if the actor is more famous than the character being portrayed."

Performance Art
The third category is performance art, which consists of productions such as dance, aerial-ballet and mime where the communication of any message is done largely non-verbally. Hawkey (2003) reports having mixed success with dance and aerial-ballet. However, the Natural History Museum had greater success with 'Blue Boys', a production that, using mannequins and mime, was intended to stimulate the audience into questioning the purpose of the museum's collection. Why are they being shown an object, and does it matter if it is real or a reproduction? This aim is closely related to the aims of the pieces of art, by Hirst and Dion, described at the start of this section and is a good example of a museum trying to educate its visitors in how to use its collection.

5.2 Design

5.2.1 Garden Design

As Rae (1996) points out, "little contemporary text exists on the design of botanic gardens". This is probably partly due to the infrequency with which there is an opportunity to design a garden from scratch, and because the process is similar in many ways to the design of parks, large gardens and other public spaces on which much has been written. '*The Darwin Technical Manual for Botanic Gardens*' (Leadlay & Greene 1998) is one document that does deal specifically with the design of botanic gardens whilst Mittelstadt (1990) has written about the basics of garden design but aimed it at the botanic garden community.

When designing pathways, Mittelstadt (1990) suggests a three-tiered system with primary paths of at least 3.0m (10') wide for the main circulation throughout the garden, secondary paths, 1.8m (6') wide for lighter traffic, and tertiary paths that are 0.9-1.2m (3-4') wide and made of a loose material such as gravel or bark chips. Installing the correct width of path is essential for the garden to hold a large

number of people without feeling crowded. As Lakota & Kantner (1976) have shown with their work on museum galleries, the capacity of a gallery to handle large numbers of people is dependant on the width of its major paths. Consideration should be given to wheelchair users. According to Leadlay & Greene (1998) any path under 1.2m (4') wide is unsuitable for wheelchairs and while using loose material for paths can give an additional textured element to a garden it can also hinder wheelchair users and therefore should be avoided or only used as a very shallow covering to an existing path. It must also be remembered that, in addition to transporting visitors around the garden, the paths will be used by staff to get around. Therefore paths must be large enough to allow access with horticultural, and other service, machinery to all areas that it might be needed.

Many botanic gardens in Britain suffer from a lack of adequate lighting, especially in glasshouses. As Mittelstadt (1990) notes, not only is lighting important for safety if the gardens are to be used at night (or even during dark winter afternoons) but it can also be used artistically to display the gardens plants. For some time Westonbirt Arboretum has been illuminating its trees for evening openings and more recently Kew has put on displays of Christmas lights.

Both Leadlay & Greene (1998) and Mittelstadt (1990) recommend that there should be a consistent design style running throughout the whole garden in order to create a coherent image. This is true to certain extent, whilst having a common system for labelling, for example always giving the common name of a plant first followed by Latin in italics, aids the visitors ability to interpret a collection, it does not have to be applied so rigorously to other elements. Mittelstadt suggests that site furniture should also be the same throughout the garden, he also suggests dividing the garden in to smaller rooms, but there is no reason why these rooms cannot have different characteristics and thus furniture that matches. Whichever method is followed it is important to ensure that each element of a design is assessed against a clear design brief to confirm that it is doing what it is meant to be doing and that it does not distract from the intended message and atmosphere of the design.

Children's gardens have been in existence, in one form or another, since the first half of the 19th century. However, these were traditionally places for children to actively partake in gardening. Over time this has changed and now the trend in America is to build interpretive gardens specifically to be used by children (Mattern 1999). Shair (1999) gives Michigan State University's 4-H Children's Garden and the Everett Children's Adventure Garden at the New York Botanical Garden as examples of this. These are perhaps analogous to the hands-on sections in museums, such as Launch Pad at the Science Museum in London and Discovery at the Natural History Museum, also in London. So far this trend for children's areas in gardens has not been prolific in Britain. However, for a number of years the Royal Botanic Gardens, Kew, have had a small garden reserved for children on Kew guided school visits and at the time of writing they are recruiting volunteers for a publicly accessible children's garden, called 'Climbers and Creepers', that will open in the summer of 2004 (RBG Kew Website 2004b). Whilst children's areas can be beneficial, care must be taken that it does not segregate children and reinforce a view that anything outside their area is not for them. It is important that there are exhibits of interest to all age ranges distributed throughout a garden. A more cynical reason for opposing children's gardens is that in the minds of some curators building a children's area may be seen as removing the need to address interpretation in the rest of the collection.

5.2.2 Exhibit Design

There has been a lot written about the design of exhibits, for instance the book '*Design of Educational Exhibits*' by Miles *et al*. (1988), and although nearly all of this is from the museum perspective, a great deal is applicable to exhibits in a botanic garden context. Many of the works deal with how visitors behave in exhibits, for instance, Miles *et al*. inform us that there is a tendency for people, on entering a

gallery, to turn right, while Schramm & Porter (1982) have proposed the 'Fraction of Selection', shown below, which illustrates how visitors will assess an exhibit and if they feel that the effort required to view the exhibit is greater than any reward they might receive they will bypass it.

$$\text{Fraction of Selection} = \frac{\text{Expectation of Reward}}{\text{Effort Required}}$$

Therefore a successful exhibit or sign must have a high fraction of selection i.e. a high expectation of reward and a low required effort.

Miles *et al*. (1988) believe "…an essential part of a visitors experience of a museum is the freedom to see what he wants, in his own time" but they advise that previously seen exhibits should be screened from visitors as should unvisited displays that could be distracting. Melton (1935) has shown that visitors pay less attention to displays the closer they get to the exit – the 'exit gradient theory'. It would therefore seem appropriate to conceal the exit but this must be done carefully because, as Lakota (1975) has demonstrated, visitors are reluctant to commit to what visually appears to be a large exhibit, presumably because it tips the fraction of selection against the exhibits favour.

On average, Miles *et al.* (1988) expect each concept to require 5 displays, each being about 900mm wide. This places the comfortable viewing distance at about 1700mm, which would run the risk of people walking in front, but by adjusting the texture or height of the space between the viewer and the exhibit this is less likely to happen. They expect that approximately 80% of the gallery space will be used for circulation; with botanical collections the proportion of bed to path can vary widely depending on the type of display. For instance, a large rock garden will probably have far more growing area than path, while an arboretum may have large expanses of area usable by the public.

In addition to this there is also a subtle unspoken visual language based on previous experience that affects the way an object is perceived, based on the way it is displayed. Miles *et al*. (1988) give a series of examples of how the positioning of an object in relation to itself and the viewer will effect the viewer's perception of that object. For example, a vase displayed in a cabinet with a number of other identical vases will be perceived as being less important than if the same vase were displayed in its own case and surrounded by a barrier of red rope. Exhibit designers are not the only ones to be aware of such phenomena. Garden designers employ similar techniques to manipulate the visitor's experience. For example, the feelings evoked while walking around the maze at Hampton Court Palace, London, are different from those felt whilst walking on the lawns. In both cases you are walking on either gravel or grass and are surrounded by yew trees, but the difference in feelings is generated by their placement in relation to the viewer. When mastered this unwritten visual language can be used to manipulate the visitors' experience.

5.2.3 Art & Sculpture

As de Bray (2001) illustrates, the association between the visual depiction of plants and the gardens that grow them can be traced back to the medieval monasteries and even beyond. Botanical art, the art of drawing plants accurately enough that they can be used for identification, research and education, has naturally been important to botanical gardens, many of which have collections of paintings and drawings. For example, in 1879 the botanical artist Marian North offered Kew her paintings and a gallery to house them in return for a studio attached to the gallery. Kew accepted and her work can still be viewed in the resulting building (Desmond 1995). Botanical art is still produced at Kew for professional purposes and in 1988 Cambridge cottage was converted in to a gallery for its display.

More recently, an exhibition area has been opened in the White Peaks complex for the display of paintings, drawings and photographs. In addition to these public display areas, Kew holds collections of botanical art in the herbarium.

The desire to create gardens that are aesthetically pleasing often resulted in the inclusion of statuary. This can be symbolic, as with the placements of busts and statues, such as that of Sir Hans Sloane in the Chelsea Physic Garden, or the creation of grand entrance gates at Oxford Botanic Garden designed by Inigo Jones (Oxford Botanic Gardens 1972). Ornamentation can also be used to increase the amenity value of the gardens and thus attract more visitors, as was demonstrated in section 1.2.1.4, which discusses the public enlightenment movement.

However, some botanic gardens have recently started to view artistic and sculptural elements as being an additional medium for interpretation as well as enjoyment; the Eden Project has worked with in excess of forty artists, including "…sculptors, automata makers, musicians, performers, painters, mosaic artists, weavers, dancers, stone-carvers, cartoonists…" (Eden Project Website 2004a) to add to the visitor's experience. By enhancing the visitors' experience Eden hopes that the visitor will form an emotional link with the place, the plants and ultimately the message they are trying to convey. For this approach to work the design and placement of pieces of art should be considered at the same time as the design of the surrounding plantings. If this is not possible an artist should be chosen who will create a piece that is specific to the location and the story being told. If this is not done, the piece will bear little relationship to the story that is being told by the plants and the interpretational value of the piece will be lost.

5.2.4 Assessment

Any venture should be constantly assessing whether it is achieving its aims and whether those aims are still valid. Unfortunately, Beckmann points out that, "…many botanic gardens, especially the smaller ones, regard formal evaluation as a luxury, to be engaged in only rarely, if at all" (Beckmann 2000). This view is supported by Bromley (2004 pers. comm.) and Hatherly (2002) who made the following statement at the Museum Australia Conference 2002 -

> "*…while visitor profiles and expectations have been gathered for years in botanic gardens, commitment to strategic evaluation in order to design effective displays and test learning outcomes is still fairly embryonic. I know of no botanic garden where budget funds are allocated specifically to visitor research and evaluation or where a staff position has been dedicated to this purpose.*"
>
> (Hatherly 2002)

This applies equally to British botanic gardens with possibly one exception. The Eden Project currently employs a member of staff, Andy Jasper, solely for the purpose of visitor research and evaluation. As Beckmann (2000) illustrates there are many different methods that can be used for evaluating a variety of aspects of botanic gardens. These range from focus groups and video analysis of visitor movements through to staff observations and informal visitor comments but all can provide valuable insights into how the visitor use and perceive that garden. The evaluation completed to date includes reports on the results of *Quantquest*, a regular visitor survey, which aims to assess the demographics of the visitors, what transport they used to get to the garden and their feelings about the site (Jasper 2004), and *The Economic Impact of the Eden Project* (The Eden Project 2003), in which the financial and other impacts Eden has had on the surrounding areas is assessed. As one of the Eden Project's aims is to create a positive change in the country's attitude and understanding of their message, they are now working on ways of trying to assess the influence they are having on a countrywide scale (Jasper 2004 pers. comm.). (More details of the assessment techniques used by Eden can be found in the Eden case study in chapter 6)

5.2.5 "Plant Blindness"

The 15° Laboratory, based at Louisiana State University in the USA, is dedicated to conducting "science education research targeted at improving students' learning of important biological (and especially botanical) concepts, principles, and theories" (15 Degree Laboratory Website 2004). The laboratory's director, Jim Wandersee, and Elisabeth Schussler of the South-eastern Natural Sciences Academy, have done a great deal of work looking at why people tend to be less interested in plants than in animals, and why plants are often overlooked in their own environment (Wandersee & Schussler 1999). One piece of their work that came out of this, and is of particular interest to botanic gardens, is their theory of plant blindness. They define plant blindness as-

"The inability to see or notice the plants in one's own environment –leading to: (a) the inability to recognize the importance of plants in the biosphere, and in human affairs; (b) the inability to appreciate the aesthetic and unique biological features of the life forms belonging to the Plant Kingdom; and (c) the misguided, anthropocentric ranking of plants as inferior to animals, leading to the erroneous conclusion that they are unworthy of human consideration." (Wandersee & Schussler 2001)

They then go on to try and give reasons why animals and animal study is more popular than plant study. The points listed below give exhibit and botanic garden designers an extra set of guidance to use when considering their future designs.

1) Humans tend to only recognise (visually) what we already know or has meaning to us.
2) Chromatic and spatial homogeneity caused by lack of flowers and lack of edges when plants overlap makes recognition less likely.
3) Humans are attracted to moving objects over static ones. This is probably an evolutionary trait left over from when it was vital to spot the movement of a potential predator amongst foliage.
4) Humans group objects into bulk visual categories, thus individual plants may be de-emphasized, with the totality being labelled simply as 'plants'
5) Plants are perceived as non-threatening so are of low priority. Where plants are threatening, e.g. poison ivy, people focus on looking for them.

(Adapted from Wandersee & Schussler 2001)

These rules can be used in two ways; firstly, to estimate whether a plant is going to be of interest to visitors or not and, secondly, to suggest ways in which less interesting plants can be made more appealing. When the British flora is considered using these rules the following observations may be made. Holly, ivy and mistletoe will be recognised by the general public as they are all used during Christmas celebrations and thus have attached meaning. More attention will be paid to individual shrubs growing in a hedge when they are in flower, and are thus differentiated from the rest of the greenery, than when they are not flowering. Britain's flora does not possess the well-known moving plants, such as the Venus flytrap (*Dionaea muscipula*) or the Sensitive Plant (*Mimosa pudica*), but it does have some plants that move. For instance, on hot days the seedpods of gorse (*Ulex spp*.) can fire their seeds with amazing speed. Similarly the Indian balsam (*Impatiens glandulifera*) also has touch sensitive seedpods. The lack of obvious distinguishing characteristics makes grasses one of the hardest groups of plants to identify and as a result even people who otherwise have a good plant knowledge will often ignore individual species preferring to group them as just 'grass'. Britain does not have a particularly dangerous flora, however, both brambles and nettles can inflict a certain amount of pain and thus are recognised by many people who are otherwise unfamiliar with plants.

There is an additional problem encountered when trying to display a native flora to the inhabitants of that country, and that is familiarity. A combination of recognising what we already know and the tendency to classify things into larger groups means that often we see these plants just as a green backdrop to our every day lives. This is not a phenomenon restricted just to plants. For instance nearly every day we handle coins but not many people could say what is written on them.

When used the other way around the rules provide guidance for improving the appeal of displays. Rule one shows that giving the visitor a way of associating a plant with a pre-existing interest will add meaning to that plant and make it more recognisable in the future. Rules two and four show that isolating plants from others will draw attention to them. This occurs in many alpine houses where plants are displayed individually in pots. Whilst this is primarily done for horticultural reasons (allowing a quick turn around of display material and specialised growing conditions) it does persuade visitors to view each plant individually. Conversely, Gibbons (2002) believes that another good way of drawing attention to a plant is to grow it *en-mass*. He states "People living in temperate countries with small floras all too frequently under-appreciate their own wildflowers". Wanting to draw attention to our flora he has compiled a book of photographs of plants flowering *en-mass*. Rule three suggests that movement is important. As has already been discussed, plants with quick and repeatable movements are uncommon in the plant kingdom, but, as the BBC's documentary series '*The Private Life of Plants*', narrated by David Attenborough, demonstrated, with the use of time-lapse photography the seemingly inanimate can be 'brought to life'. A good example of this was a shoot of bindweed (*Convolvulus spp.*) entwining itself around a branch. Rule five would suggest that by drawing attention to the threats certain plants pose to humans these plants will take on importance to that person. However, as with plant movement, a threat does not exist in every plant. To compensate for this the visitor could be persuaded to view the plant from the position of another species and explain how the plant is a threat to them. For example, imagine that you are an insect caught in a Sundew (*Drosera spp.*) and being dissolved alive. Whilst using the last rule may increase visitors' memory of that plant it could prove controversial for the following reasons. There has always been a debate within the botanic garden community as to whether poisonous plants should be labelled as such. The arguments against including this information on the labels are centred on a fear that the plants might be taken by visitors and used to harm someone. Counter to this is the fear that an accidental poisoning in the gardens from a plant not labelled as poisonous could lead to legal action. In addition to this there is an argument that labelling plants as dangerous may impart a negative view of plants, i.e. 'plants are bad for you', which would counter the objective of trying to raise informed interest in them. Therefore, these issues should be thoroughly considered when designing interpretation material.

5.3 Summary

This chapter set out to examine education, the design of the garden and its interpretation. The result demonstrates that the fluid link between scientific-artists and artistic-scientists illustrates that skills from both disciplines are needed to communicate ideas effectively with visitors. An understanding of how humans gather and process and store information from our environment can help interpreters to design exhibits that are more successful at achieving their aims. There is also a wide variety of media available to choose from when selecting a method of interpretation. The differences between these media and their suitability for the specific situation must be understood so that the best medium, or suite of media, is picked. The results of a review of botanical collection websites suggest that the use of websites as a tool for education is not presently being utilised.

A large body of research is available that examines both education theory and exhibit design which can be used as a guide. One of the educational models suggests that knowledge is constructed and can be mis-constructed. As a result of this, a Socratic method of teaching is better at identifying and rectifying mis-constructed frameworks.

The physical environment has also been shown to play an important role in the learning process at a number of levels, including its use as a physical *aide-mémoire* and thus the design of botanic garden can be viewed as an extension of the exhibits its houses. An important element of any interpretation programme is regular assessment to confirm that the educational aims are being met. However it appears that in the majority of botanic gardens this is not being done.