

Abstract

Communication has always been part of human society but has become much faster with the advent of the Internet, which has made enormous quantities of information accessible to the masses; approximately 20% of the global population now has Internet access. The *About Bamboo* website was designed to explore the principles of website design and demonstrate the multiple uses of bamboo as a sustainable natural resource. Bamboos are extremely diverse, fast-growing, renewable and cheap to produce; there are c. 1200 species in 91 genera and an estimated 5000 uses for bamboo products. Bamboos are widely grown in China and India, where they are central to the culture and lifestyle of indigenous populations. They provide food for humans, timber for construction and the manufacture of furniture, clothing and numerous other consumer durables, and may be used to address environmental issues such as erosion, pollution, earthquakes, deforestation and provision of habitat for endangered species. Their extreme versatility suggests that bamboos should be promoted more widely as a sustainable resource.

For websites to communicate information effectively, their design and content must be carefully planned so they are accessible to everyone, irrespective of browser, Internet connection speed, operating system or screen resolution; they must also be accessible to people with disabilities. The target audience must also be considered, in this case biology students wishing to learn about bamboo through English or French language. The content was adapted accordingly and a supportive learning environment created by including games and fora. User surveys provided positive feedback and suggestions for improvement. This review considers the multiple uses of bamboo in developing countries and the principles involved in producing effective websites for a global audience.

Communicating science through a dynamic website: the multiple uses of bamboo

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Communicating information is an essential element of human society, whether to spread news or transfer knowledge. Today, the most common and effective way of exchanging knowledge is via the Internet, which links universities, governmental and industrial organisations and private individuals, enabling rapid transmission of information. Although creation of websites to convey scientific knowledge may seem straightforward, numerous details must be considered, including both obvious, such as achieving a pleasing aesthetic design and providing accurate information, and less obvious features such as accessibility and compliance with Internet guidelines. *About Bamboo* focused on how to optimise communication of information regarding the multiple uses of bamboos in developing countries via an interactive and dynamic website.



Figure 1. Diversity of culm colours and shapes in *Phyllostachys* (Source: Bamboo Central)⁴.

Bamboo and its multiple uses

Arber¹ stated that "it would hardly be possible to exaggerate the importance of bamboos to the life of man in the tropics", while Bystriakova *et al.*² concluded that bamboo "plays a considerable role in improving the livelihoods of rural poor people". Bamboos are members of the *Bambusoideae*, a subfamily of the Poaceae.³ They range from dwarf species such as *Pleioblastus pygmaeus*, which grow no taller than 10-15 cm, to giant bamboos such as *Dendrocalamus giganteus*, which grow to over 35 m.¹ Their leaves, which are produced alternately in two opposite rows on the stem, also vary, with those of *Planotia nobilis* being up to 4.5 m long and 30 cm wide, whereas those of *Arthrostylidium*

capillitifolium are thin and hair-like. Some have modified hairs at the internodes which resemble thorns, including *Aruninaria* species.¹ Bamboos may be woody or herbaceous; the former evolved to compete for light with trees and may themselves form forests. Besides differences in texture, the culms, or stems, differ in colour, showing varying tones of green and/or yellow, with or without stripes (Fig. 1). Bamboos are native to all continents except Europe and Antarctica, but are now widely distributed in Europe. Although predominantly found in tropical, subtropical and temperate regions, species such as *Neurolepsis aristata* grow at altitudes of up to 4300 m in the mountains of China.³ Their natural distribution ranges from 50 °N on Sakhalin Island (*Sasa kurilensis*) to 47 °S in Argentina (*Chusequea culeou*; Meredith)³; species richness is greatest in the Asia Pacific region where c. 142 species are found.²

Bamboos are the second fastest growing group of photosynthetic organisms after giant kelp, a marine alga, and possess rhizomes, culms, branches and leaves. Rhizomes and culms have nodes and internodes, the former being solid disc-like structures, while the latter are the hollow segments between nodes. Roots emerge at the nodes of rhizomes, while the culms produce branches bearing leaves. Culms attain their final external diameter before emerging from the ground³ and resemble a telescope as the nodes are all already present; the thickness of the walls decreases as culm height increases.⁵

Bamboos exhibit two types of vegetative propagation via their rhizomes, which form dense underground systems containing substantial storage reserves. Runner types such as *Phyllostachys aurea* are highly invasive as the rhizomes extend rapidly unless controlled by barriers. Clumping types such as *Chusquea culeou*⁶ are much less invasive and form dense clumps which cease to produce new culms when they attain their ideal diameter and subsequently increase only in height.³ Clumping types are ideal for providing hedges on farms as they form impenetrable barriers without invading adjacent cropping land. Biological and environmental factors controlling flowering are poorly understood because of the unusual flowering patterns of bamboos, which fall into three categories, continuous, gregarious and sporadic.² Continuous flowering occurs throughout the year without causing plants to die, whereas gregarious flowering poses a significant threat to animals such as the Chinese Giant Panda, as the entire community flowers and dies over a 2-3 year period, depriving other organisms of shelter and food; some species remain vegetative for 50-70 years before flowering and dying. Sporadically flowering species, flower at certain times of year or intermittently over extended periods.

Bamboo as Food

Bamboo is an important food source for humans, most commonly in the form of shoots of *Bambusa vulgaris* and *Phyllostachys edulis*, which are eaten raw or salted, pickled, fermented, fried or grilled.⁷ Taiwan alone consumes 80000 t yr⁻¹ of bamboo shoots⁸, while its seeds and fruits are eaten in the Americas and South East Asia.⁹ Bamboo is used to produce alcoholic beverages in Tanzania, where wine known as Ulanzi is produced by fermenting sap from *Oxytenanthera abyssinica*^{1,7}), while leaves are used in China to produce bamboo liquor or add flavour to beer. Antioxidants in bamboo fibre which prevent bacterial growth are used as a natural preservative for food in China, where culms or bamboo sheaths are used to store rice or sushi.¹⁰

Bamboo for Timber

Bamboo has a reputation as a "poor man's wood"¹¹ because of its key role in Asia, Latin America and Africa, where woody species provide sustainable supplies of timber. Although hollow, the culms are woody due to the presence of lignified fibres and tracheids and silicium dioxide (SiO₂). Bamboos have several advantages for timber production, including rapid growth as their culms may extend by 1 m d⁻¹ in fast growing species. New shoots are produced after existing culms have been harvested so there is no need to replant, and the harvest cycle is shorter than for trees as culms reach maturity and maximum strength in 4-5 years, compared to 20 years or more in trees.

As clumping species produce dense stands containing up to 200 culms, each up to 30 m in length, bamboo requires less land to produce an equivalent weight of wood than trees⁸; thus, the average American home requires c. 1 acre of forest to produce sufficient timber for its construction, whereas the footprint of the house would be sufficient if planted with bamboo.¹² Moreover, bamboo is rarely attacked by pests and can be grown without costly and environmentally unfriendly pesticides.

Bamboo can be used for all structures normally constructed from wood by using the culms directly or after processing to produce plywood, laminated flooring or other materials. Bamboo is strong and durable and may endure for 200 years without chemical treatment. Its culms have a tensile strength of 1000-4000 kg cm⁻², compression strength of 25-1000 kg cm⁻², bending strength of 700-3000 kg cm⁻² and elastic modulus of 100000-300000 kg cm^{-2,7}. Bamboo is important in providing low-cost housing in countries such as Ecuador where 70 % of the population has an income of less than US \$1 d⁻¹ and cannot afford cement-based homes. Viviendas del Hogar de Cristo, established in the 1970s, builds 60 houses d⁻¹ constructed entirely from bamboo except for their zinc roof.⁷ These are seismically safe due to the high tensile strength and mechanical properties of bamboo; thus, when Costa Rica was hit by an earthquake registering 7.6 on the Richter scale, bamboo houses at the epicentre survived whereas concrete buildings were destroyed.

Bamboo for Manufactured Goods

Bamboo may be used to manufacture numerous products such as furniture, including chairs, tables and beds, laminate and matting for flooring and wall coverings, and can be used to generate income for subsistence communities by encouraging the production of commodities and handicrafts for sale. Thus, young branches can be used to produce basketry and other goods for sale locally, to tourists or on the international market. By teaching villagers how to manufacture furniture, musical instruments, bicycles, fish traps, fencing, paint and tourist goods, successful businesses can be established. When reduced to pulp, bamboo can be used to make paper and durable fabric with biocidal properties for clothing. In various blends, these fabrics can be used to produce all types of modern clothing including tee-shirts, towels, trousers, sweaters, socks and dresses. They are highly breathable, moisture absorbent and hypoallergenic, and an ideal alternative to cotton as they do not involve genetically manipulated organisms (GMOs) or require fertiliser or pesticide inputs to produce high yields. Bamboo fabric is biodegradable, unlike synthetic fibres from non-renewable petroleum sources.¹³ The last five years have seen a substantial increase in demand for sustainable and environmentally friendly materials such as bamboo composites for bicycles and bio-plastics for mobile phones and disposable picnic-ware.

Bamboo for Conservation

Bamboos also provide a range of environmental services. For example, they increase biodiversity and provide habitat for animals such as mountain bongo (*Tragelaphus euryceros isaaci*), an antelope found in East Africa which spends the dry season in bamboo thickets (*Yushania alpina*)^{2,14} and is on the IUCN red list of endangered species. Bamboo rats (*Rhizomyinae* spp.) burrow between the rhizomes and feed on the roots¹⁵, while bamboo forests occupy 180,000 km² in Amazonia and provide essential habitat for the 4-5% of the birds found only in these forests.¹⁴ Bamboo forest in north-eastern Madagascar is home to the world's most endangered tortoise, the Madagascar Angulated tortoise (*Geochelone niphora*)¹⁶ while the climbing and poisonous mantella frog (*Mantella laevigata*) uses broken bamboo culms as breeding sites. Thus, many animals depend on bamboo as a source of food and shelter, including the talismanic giant panda (*Ailuropoda melanoleuca*) which eats only bamboo¹⁴; other notable examples are the spectacled bear (*Tremarctos oranatus*), mountain tapir (*Tapirus pinchaque*), the greater and golden bamboo lemurs of Madagascar, both critically endangered, and the eastern mountain gorilla (*Gorilla beringei bering*) in Africa.

Bamboos release 35 % more O₂ through photosynthesis than equivalent areas of hardwood forest and absorb almost five times as much greenhouse gases.¹² They are highly effective in CO₂ fixation because of their rapid biomass production and high carbon content (50 % of dry weight⁷; moreover, their biomass increases by 10-30 % annually compared to 2-5 % for trees, enhancing their suitability for carbon sequestration, which may reach 12 t ha⁻¹ yr⁻¹¹⁷. Bamboo can also reduce CO₂ emissions when used to produce a plant-based resin, polybutene succinate (PBS), and bamboo fibre as a substitute for petroleum-based resin and wood.¹⁸ Thus, bamboo may be used both to sequester CO₂ and reduce CO₂ emissions, while simultaneously releasing O₂ and producing economically valuable biomass. Bamboo may also provide a potentially important source of biofuel which can be used to provide energy through gasification to replace petroleum and gas supplies, which will become scarce or unaffordable by 2050¹⁹; unlike fossil fuels, this technology does not increase CO₂ emissions as it recycles CO₂ captured during production of the biomass. Bamboo has a low ash content and alkali index and high heating value and biomass production, all desirable features for biofuels.⁷ Production of charcoal for soil improvement, air and water filters and heating is also an emerging industry.²⁰

Environmental problems are endemic in the tropics as climatic conditions and poor husbandry reduce soil stability, increase erosion and diminish crop yields. As farmers cannot afford fertilisers, the soil remains infertile and, with ever-growing populations, it becomes increasingly difficult to produce sufficient food. As populations increase, they produce more waste and rivers become increasingly polluted due to poor sewage facilities. Some scientists predict that fresh water supplies will be exhausted by 2100²¹; this problem is particularly acute in drier parts of the tropics where 60 % of the population has no access to clean water²². There is a pressing need to resolve these issues, in which bamboo may play a key role. Deforestation in Africa has caused flash flooding and landslides and losses of 15-35 t ha⁻¹ yr⁻¹ are common in areas where soil conservation is not practiced.²³ Bamboos reduce erosion in two ways as their rhizomes bind the soil³, while their canopy may reduce runoff by 25 %²⁴. In addition to improving soil quality and fertility, bamboo may increase crop yield by providing windbreaks or shade; thus, in intercrops containing alternate rows of bamboo and crops, bamboo provided protection from the scorching sun.²⁵ Bamboo may also be grown during fallow periods to restore soil fertility, while its year-round production of leaves with a high protein content (12-19 %) provides a reliable source of fodder.⁷

Bamboo may be used to decontaminate soil and water by phytoremediation, a natural way of removing pollutants using plants, restoring soil to statutory safe limits. Thus, bamboo may be planted on river banks or manure heaps to absorb nitrogen, potassium and phosphate, which are essential plant macronutrients present at high concentrations in agricultural waste. If left unchecked, they may be leached, contaminating watercourses and drinking water and causing eutrophication. As bamboos are generally pioneer species, they can tolerate nutrient-deficient soils and may be used to improve the fertility of degraded land by producing substantial quantities of litter which forms a thick humus layer and improves soil nutrient status. They may also be used to extract pollutants such as trace metals, oil and pesticides from soil or irrigation water²⁶; removal of excess nutrients and contaminants by phytoremediation may alleviate pollution in areas where water shortages and pollution pose increasing problems. Bamboo is being used to combat pollution in Lake Victoria, where human waste, chemical residues and urban and industrial effluent has caused eutrophication²⁷; explosive invasion by water hyacinths has decreased biological activity in the oxygen-depleted water and impacted on once-profitable fishing activities. An even worse situation exists in one of the largest slums in Africa, Kibera in Nairobi, where 1 m people produce 420 t d⁻¹ of untreated sewage; the effluent is further contaminated by industrial waste, but is used by residents for domestic chores and irrigation as they have no alternative. Crops grown in urban agriculture exceed safety thresholds for human consumption of trace metals (cadmium,

lead, copper and zinc). Planting species such as *Dendrocalamus giganteus* on the margins of contaminated watercourses helps to remove pollutants and reduce health risks associated with consumption of contaminated crops²⁸, while bamboo products can be sold to generate income to purchase food grown on uncontaminated land.

Review of website design

When deciding which software package to use, Macromedia Dreamweaver and Microsoft FrontPage were considered but discarded following the discovery of Joomla! The former are desktop packages which allow websites to be written largely offline, but are expensive and require major time investment to master. Joomla!, a free CMS (Content Management System), differs by creating sites only online and has 'two level control', the first being the 'Administration Panel' which dictates the content and aspect of the website, while the 'User Level' enables users and administrators to input information without damaging the core website. Joomla! is ideal for beginner or intermediate web designers as no coding is needed and everything can be managed from an interface; all that is needed for a basic website is to choose a template, upload pictures and write the articles. Downloadable components can be added to personalise sites, such as the 'Statistics' component which informs webmasters and visitors who is online. For those wishing to take editing to a more advanced level and alter templates and components (as was the case for *About Bamboo*), the core HTML coding may be modified, taking web design to an intermediate level. With Joomla!, webmasters may use Cascading Style Sheets (CSS), PHP and html when coding. CSS loads the website template into a user-friendly editing sheet, although designers must login to the Internet to undertake editing, unlike Dreamweaver and FrontPage.

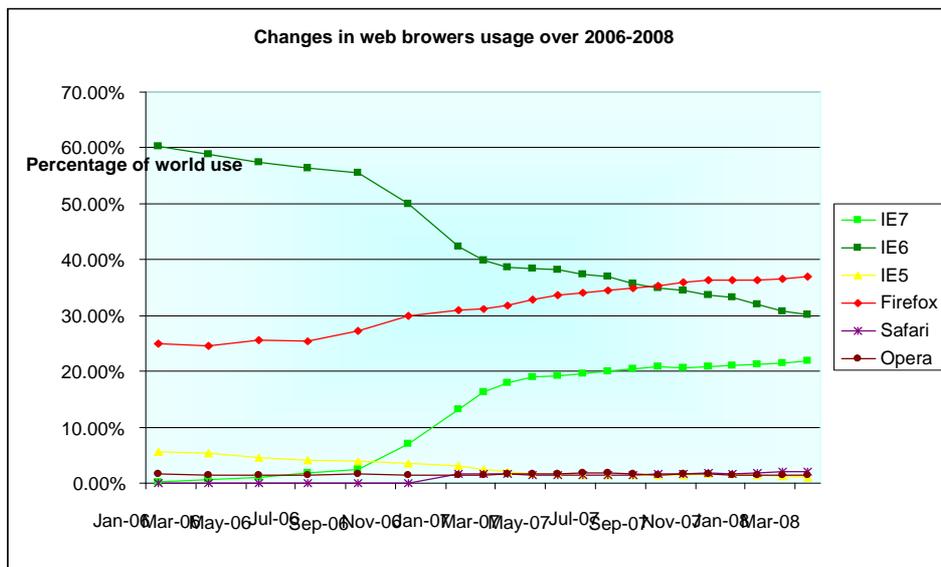


Figure 2. Popularity of web browsers between 2006 and 2008; Figure drawn using statistics available at W3schools.³³

To access the website on the Internet after downloading Joomla!, it is necessary to create a personal page with an address on a server which accepts PHP and MySQL languages, in this case <http://free.fr>. File Transfer Protocol (FTP) software is used to link the website hosted by the server to the user's personal computer; FileZilla is one of many available. Its main advantage, besides being free, is its user-friendliness and compatibility with different operating systems (Windows, UNIX, Linux, Mac). FileZilla acts as a file transfer platform (e.g. templates, images, packages or other files) with a simple drag and drop function between websites and local computers.²⁹

When editing CSS templates, it is beneficial to use software which helps to organise coding such as Notepad++, a code editor which supports over 40 coding languages and is popular with web designers, despite being available only for Microsoft Windows. Notepad++ is free, available in many languages, compatible with different coding protocols and user-friendly, with effective colour coding, multi-views and the ability to edit several documents simultaneously. It is useful to have Notepad++, although coding is also possible using Joomla!, as it provides a more global view and allows designers to save templates on their computer in case the editing process goes wrong. Web Developer 1.1.5, an add-on designed for Mozilla Firefox and SeaMonkey, is another useful tool for learning CSS editing. This amazing facility gives internet users all coding for any page visited on the Internet, enabling them to duplicate style, font, format, picture, menu or anything else by adding a tool bar to the menu of the browser; it also enables visitors to disable CSS if websites are slow to load pictures and allows designers to check coding for their pages.

Although most people have broadband and most websites load quickly, pictures slow the process and should be limited in number, size and format. With regard to file size, many formats are available, the most common being JPEG, BMP and GIF, although these differ in compression and depth of colour. If not compressed, high resolution digital images may require 24 megabytes (Mb) of memory and consume large quantities of disk space. The BMP file format was created for the Microsoft Windows operating system. In digital photography, where every colour has a key role, BMP is the most appropriate format as it does not compress pictures. The most common compression file is JPEG or JPG (Joint Photographic Experts Group) as this produces small files without significantly affecting image quality. GIF (Graphics Interchange Format) provides very small files as they are limited to 256 colours but are suitable only for simple diagrams or colours. When mounting pictures, it is best to convert these to JPEGs to reduce loading time.

As text is important in conveying a strong visual impact, it is vital that appropriate typeface, font size and line spacing are chosen (Table 1).

Table 1. Influence of typeface and font size on readability. Top box: Arial (sans-serif), 1.5 spacing, size 12. Bottom box: Century Schoolbook (serif), 1 spacing, size 10.

<p>For web text it is better to use sans-serif font, 1.5 spacing, and size 11 minimum. For web text it is better to use sans-serif font, 1.5 spacing, and size 11 minimum. For web text it is better to use sans-serif font, 1.5 spacing, and size 11 minimum.</p>
<p>For web text is better to use sans-serif font, 1.5 spacing, and size 11 at least. For web text is better to use sans-serif font, 1.5 spacing, and size 11 at least. For web text is better to use sans-serif font, 1.5 spacing, and size 11 at least.</p>

Sans-serif fonts are preferable to ensure websites are easily accessible and legible, particularly as unusual fonts cause problems for visitors whose browsers do not support them. Text size is also vital as it may be difficult to read if it is too small, especially for elderly and visually impaired visitors; the standard default for printers and browsers is Times New Roman 12pt. Font size also makes viewers subconsciously assess document size, structure through headings and sub-headings, and the quantity of information presented. Excessively large font requires visitors to constantly scroll down the page, conveying the impression of excessive information, thereby making processing more difficult and increasing viewer fatigue. Viewers' preferences regarding font size depend on their eyesight, font, screen size and resolution and personal taste. Line spacing is

important as the standard spacing (1pt) for small font sizes is likely to deter readers. Using 1.5pt spacing 'lightens up' dense blocks of text when viewing material on screen or in hard copy. Colour contrast is also crucial; as the strongest contrast is between black and white, choosing dark and light colours for text and the background is usually safe. There are websites which enable designers to check whether contrast is sufficient (e.g. <http://juicystudio.com/services/colourcontrast.php>).

Thus, when designing websites, it is important to limit the number of animations, compress images without damaging them and maintain reasonable font size and aesthetically pleasing presentation; excessive numbers of pictures or media files can dramatically slow the loading of pages. Making websites interactive using flash animation should be approached with caution as excessive use may make viewers feel nauseous and is slow to charge on dialup or slower versions of broadband; the key to effective design has more to do with accessibility than hi-tech features.³⁰ However, other factors besides visual impact are critical, including accessibility, practicality, interest and relevance of content. Before designing a website, it is essential to decide its topic, objectives and content, which must be suited to the level of the target audience. It is vital to design a 'skeleton' contents list and decide how features should be linked to avoid navigation difficulties; easy navigation is paramount for visitors to find all available information. It is important to verify that all internal and external links are functional, while content must be factually correct, current and supported by appropriate external links. It is advisable to include a site map showing site structure and providing links to all articles to facilitate navigation.

Visitor numbers may be boosted in several ways: firstly, appropriate keywords must be selected (e.g. 'bamboo' and 'Nottingham'); secondly, websites can be advertised on community websites such as Facebook where it is easy to find people with similar interests; and thirdly, links can be added to related websites and requests made to be included on these sites, creating a network. Feedback is crucial in helping web designers to evaluate the effectiveness of their sites and make improvements by identifying aspects which may have been missed or difficulties experienced by users. Feedback can be collected by providing an email address with an empty text box, or providing an online form containing specific questions; it is advisable to use both to obtain constructive comment.

Unwritten web standards are known as 'netiquette'. Although most are commonsense, the World Wide Web Consortium has published standards which designers are encouraged to use to make the Internet accessible to all.³¹ Compliance improves accessibility as search engines can index content more easily, whereas non-compliance reduces compatibility with some browsers, restricting access.³² Data exchange via the Internet depends on the bandwidth available and rate of transfer of information, usually measured in terms of kilobits per second (kbps), which determines how quickly files can be transferred. As download speeds differ greatly, webpage content and size are crucial. Dial-up connections, which may be as slow as 14.4 kbps and are limited to 56 kbps, involve the computer dialling a telephone number provided by the Internet Service Provider (ISP) to connect to a server; this was the first widespread means of accessing the internet, and websites developed in the 1990s are basic and load quickly as they were designed for dial-up connections. With the advent of high speed broadband and websites containing flash advertising or large images, browsing has become slow and costly for dial-up users. Broadband is the most common form of internet access and may provide connection speeds exceeding 6 Mbps. Another key factor is the web browser, software which enables users to search, view and organise information. The most common browser is Internet Explorer (IE), the default Microsoft Windows browser, but others such as Mozilla Firefox, Safari and Opera are gaining popularity; some such as Netscape are no longer available (Fig. 2.). A key difference between browsers besides layout and organisation are plug-ins, small programs which support various functions.

This demonstrates the importance of ensuring that website structure and content are accessible to all browsers, particularly IE and Firefox, which are respectively used by c. 50 % and 40 % of Internet users.³³

Various approaches may be used to ensure that all content is accessible to visually impaired users. Blind visitors use screen readers, software which reads webpage content aloud. Pictures may be replaced by text, which should be succinct and contain no more and no less information than the picture³⁴; content should be structured in small chunks to increase accessibility to the screen reader. The most common visual problem is colour blindness, where people have difficulty distinguishing between red and green. Possible solutions are to use high contrast colours and avoid shades of the same colour, or to create several designs for users to choose from. To facilitate navigation for the elderly, small fonts must be avoided and animations carefully considered; the use of drop-down menus which return to their initial position too quickly may require reflexes which elderly people lack. Modifications may also be made for people with learning difficulties such as dyslexia, for whom line spacing and contrast between the background and text should be increased. The use of beige tones, as opposed to white, for backgrounds is beneficial as they are less luminous, as can division of text into short paragraphs and adding pictures to illustrate specific points.³⁴

The About Bamboo website

It is vital to choose an appropriate name and logo to help users remember sites. The website was named *About Bamboo* (<http://aboutbamboo.free.fr>) to lead straight to the point, and because 'about' and 'bamboo' are likely to be used as keywords in searches. Effective logos which confer a unique identity require careful research and good design skills. For *About Bamboo*, a simple logo was created and the title set in bamboo-style font and placed in the banner to stand out. The JPEG format was used for photographs and large images to reduce file size, while GIFs were used for simple pictures such as the logo. When clicked on, images appear full size in a pop-up window with a title and link to the external host website; this approach was necessary as images in the text had to be reduced in size and netiquette requires that their source is given.

As well as being aesthetically attractive, websites must be logically organised to facilitate navigation and access to information. Several menus were used in *About Bamboo* (Fig. 3.). The 'Top Menu' in the page header is where people look first when searching for information and provides rapid links to all sections of the website i.e. 'Home', 'Contact Us', 'Links', 'Forum', 'Site Map', 'Language Option' and 'Search Bar'. The 'Main Menu' providing links to all main topics is located at the top left of the screen as the target audience reads from left to right and top to bottom; separators were included to distinguish between sections. Finally, the 'User Menu' allows users to log on, alter their profile and suggest articles; the latter is important for websites intended to be accessed and expanded over time. Given the biological nature of *About Bamboo*, green was chosen as the theme colour. The background, bamboo forest wallpaper, was chosen to immerse users in a forest, while different 'Classes' of font were created for main text, titles, introductory paragraphs, popup windows and captions to keep font size and colour consistent and simplify html coding. For example:

- without setting a 'class', the following coding is required: **<strong style="font-weight: bold; font-size: 12px; color: #339900; font-style: normal; font-family: Arial, Helvetica, sans-serif">Introduction**

whereas

- setting a 'class' simplified coding for the same result to: **Introduction**

'Modules' or 'Components' may be added to webpages constructed using Joomla!. Two modules were installed on *About Bamboo*, 'Online now', which shows the number of visitors logged in, and a 'User poll' which can be modified according to the webmaster's needs. A Site Map (similar to a book index) was created to show all main pages and



Figure 3. Screenshot of Homepage of *About Bamboo* Website (<http://aboutbamboo.free.fr>).

extra articles as these would not all fit into the 'Main Menu'. Drop-down menus were avoided to increase accessibility for visually impaired users.

To sustain interest and help the target student audience to assimilate information, interactive exercises including crosswords and multiple choice questionnaires (MCQs) may be included using software such as Hot Potatoes. If teachers plan to use websites for educational purposes, their educational aspect may be expanded by increasing the number and type of exercises. By using logins and passwords, exercises can be submitted directly to the teacher's email address and access-controlled (e.g. if teachers wish exercises to be completed in English to enable French students to practice their language skills). Games or exercises benefit learning by providing a break from steady concentration when reading, while helping the brain to memorise information during revision.^{35, 36} To increase the interactive aspect of the website, a forum controlled by the administrator was installed to allow users to provide feedback, report glitches and ask questions about web design. On *About Bamboo*, the application FireBoard was added to Joomla! to provide these facilities.

With an estimated 1,320 million Internet users (around 20 % of the global population)³⁷, it is often important for websites to be available in several languages. French is spoken

by 3.2 % of world’s population (169 m people) in 54 different countries in Europe, Africa, America and the Pacific.³⁸ With Joomla!, it is possible to install a component called Joomla!fish to aid translation. This does not directly translate content but connects the translated article to the original version.

To ensure that *About Bamboo* appeared correctly across the full range of operating systems (Linux, Microsoft Windows, Mac OS and BSD) and browsers (Internet Explorer, Mozilla Firefox etc.), the URL was fed into a program on <http://browsershots.org/>³⁹ which allows webmasters to select 58 combinations of browsers and operating systems under ‘Systems’. It is also possible to test appearance using different screen sizes or plug-ins (i.e. depending on whether users have installed Flash or JavaScript). To evaluate *About Bamboo*, 17 browsers were tested using screen sizes of 800 and 1024 pixels. The browsers selected were those most used in 2007³³ plus Internet Explorer 8, the latest release (Table 2); all appeared correctly, with the exception of Internet Explorer Version 5 set at both 800 pixels and 1024 pixels ; however, only 1.5 % of Internet users still use this browser.³³

Table 2. Combinations of operating systems and browsers tested.

Operating Systems	Tested Browsers				
Microsoft Windows	Internet Explorer 5,6,7,8	Mozilla Firefox 2,3	SeaMonkey 2,3	Opera 9.27	Flock1.1
Linux	Mozilla Firefox 2,3	SeaMonkey 2,3	Opera 9.27	Galeon 2	x
Mac OS	Mozilla Firefox 2,3	Safari 3.1	x	x	x

To increase accessibility, several templates were provided to enable users to optimise navigation. Templates (also known as skins) are similar to layers of clothing which can be changed according to the weather; for example, on *About Bamboo*, a wider template (1024 pixels) called ‘Widescreen’ was created to suit wide screen PCs. Another known as ‘Alternative’ was created for colour-blind people as the design chosen for *About Bamboo* uses various shades of green, which may be problematic for ‘red-green’ colour-blind viewers. The latter template can also be used for dyslexic or elderly users who need stronger contrast.

In conclusion, by exploiting the Internet, creation of the *About Bamboo* website has helped to increase the awareness of the target audience, in this case young English and French biology scholars, regarding to the global importance of bamboos as environmentally friendly sustainable crops with numerous applications. Its external links provide access to a wealth of detailed information on bamboo, while its interactive nature allows users to contribute to its continuing development and dissemination of knowledge. As Meredith³ stated, “This finite earth will one day run out of resources and space to hold the population..... Bamboo can play a role in cushioning this confrontation with the finite limits of our earth, and perhaps, one day play a role in our recovery”.

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Author Profile

Elizabeth Pillière grew up in France and completed a French Baccalaureate before going to the University of Nottingham. After completing a BSc in Environmental Biology with a European Certificate, she is now studying for an MSc in Science Communication at Imperial College, London. She then plans to work internationally to promote solutions to environmental issues.

