

# THE PRINCIPLES OF BIOPHILIC DESIGN

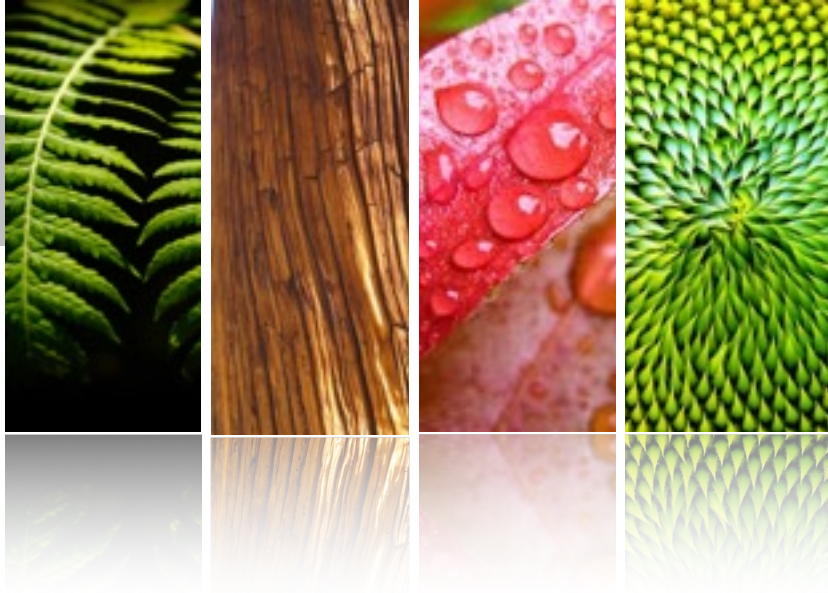
HOW THESE CAN BE PUT INTO PRACTICE IN EDUCATIONAL FACILITIES AND THE BENEFITS WE CAN GAIN FROM THIS.



Aimee Gray  
Level 6

BA(Hons) Interior Design with Sustainability

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# Abstract.

This report will be focusing on two key areas, firstly Biophilic Design and secondly how this can influence the future design of Educational facilities and the benefits we can gain from this. We will gain a better understanding of the principles, practices and history of biophilia and the benefits we can gain as human beings if we reconnect with nature and our surroundings and how this can influence our built environments.

We will be discussing the main principles of Biophilic Design and understanding the connection between people and nature and why it is essential, referencing a number of different sources including Oliver Heath a sustainable architect and interior designer and Stephen R Kellert a professor and writer specialising in Biophilia. Online journals including The 14 Patterns of Biophilic Design by Terrapin and sources such as The Guardian, arch daily, Dezeen and articles from the UK Green Building Council will be supporting this.

The Benefits of Biophilic Design and how it is currently being put into practice are discussed reviewing case studies such as the Google Headquarters in California designed by Bjarke Ingles and Thomas Heatherwick and looking into the rationale behind the design and the benefits it has on the company's employees productivity, creativity and satisfaction. Biophilia is used in a range of environments such as offices, healthcare facilities and educational environments. This report discusses the findings showing different benefits to users such as improved rates of cognitive function, faster healing processes and improved well being.

Biophilia is extremely relevant today, as the World's population continues to grow and our environment becomes increasingly more urban it is vital to look at the financial and economic benefits to embracing Biophilic Design and the impact this can have on our future.

The second key area in this report is how Biophilia can influence the future design of Educational facilities and the benefits we can gain from this. Primary research has been carried out in the form of questionnaires and interviews with parents and Case studies including St Mary's infant school designed by Jessop and Cook Architects and Vittra Schools in Sweden alongside Forest explorers and Eco Schools. Biophilic Design could be used in Educational facilities, this report discusses the benefits our children could gain from going to school in an environment connected to nature.

**“children are born as biophilic beings and have an inborn curiosity for learning from the natural world.”**

Richard Keller

# Biophilia.



([www.fallingwater.org](http://www.fallingwater.org))

Biophilia can be defined as the instinctive bond between humans, nature and other living systems. Humans have had a strong connection with nature since the beginning of time and we thrive in our natural environment, however as we have evolved we have put less emphasis on the importance of how our connection to nature can benefit us and why it is essential to maintain it. It seems only in recent years people have begun to take a step back from their current urban surroundings and search out healthier environments and understand the impact this can have on their health and wellbeing.

As humans we possess a natural desire to affiliate with nature but to gain the benefits from this it needs to be consistent and built in to our daily lives. Nature is now predominantly seen as a ‘weekend’ activity when in fact it should be our natural environment. In modern society there is a disconnection between nature and our built environments. The separation is widening and as the worlds population continues to grow our environment is becoming increasingly more urban, with developers choosing to build on what little land we have left and building for numbers with little or no consideration for satisfying our sensory needs.

Biophilic design is design that helps us reconnect with nature and our surroundings, its main aim is to create environments that provide contact with the natural world. An early and iconic example of biophilic design is American architect Frank Lloyd Wrights Falling water built between 1936 and 1939.

Frank Lloyd Wright promoted the idea of organic architecture and understood the need for harmony between nature and the built environment. Falling water encompasses the biophilic principles, most importantly that the house was incorporated into its natural environment. Wrights design integrated the house with its setting including the waterfall creating an iconic piece of architecture that has since been designated a National Historic Landmark. ([www.fallingwater.org](http://www.fallingwater.org))

For many years researchers, designers and theorists such as Stephen R Kellert author and researcher and Roger Ulrich Professor of Architecture at the Centre for Healthcare Building Research at Chalmers University of Technology in Sweden have come together to define the aspects of nature that have the most significant impact on our satisfaction with our surroundings and built environments. These have been put together and are defined as the “14 Patterns of Biophilic Design”.

# Table 1: The 14 Principles of Biophilic Design.

| Direct Connections with Nature  | Indirect Connections with Nature   | Spatial Features   |
|---|--|--|
| <b>1. Visual Connection with Nature</b><br>Views looking out onto nature and natural elements   | <b>8. Biomorphic Forms &amp; Patterns</b><br>References to patterns, textures and shapes that naturally occur in our environment                                 | <b>11. Prospect</b><br>Unrestricted views of nature  |
| <b>2. Non-visual Connection with Nature</b><br>Connection with nature and natural elements through other sensory means such as touch, smell or sound                            | <b>9. Material Connection with Nature</b><br>Create a material connection with nature using natural materials with minimum processes                             | <b>12. Refuge</b><br>Place for withdrawal from the main flow of activity without being secluded enabling the user to feel safe and protected |
| <b>3. Non-rhythmic Sensory Stimuli</b><br>This is defined as brief references to nature for a short amount of time such as clouds passing or a small breeze at random intervals | <b>10. Complexity &amp; Order</b><br>Reflects spacial hierarchy seen in scenes in nature, creating a visually stimulating environment without being overwhelming | <b>13. Mystery</b><br>The use of partially obscured views to create interest and entice the visitor further into the building                |
| <b>4. Thermal &amp; Airflow Variability</b><br>Subtle changes in humidity, temperature and airflow to mimic natural surroundings  |  | <b>14. Risk/Peril</b><br>A space incorporating an implied level of risk such as glass floors   |
| <b>5. Presence of Water</b><br>Seeing, hearing or touching water  |  |  |
| <b>6. Dynamic &amp; Diffuse Light</b><br>Different levels of light and shadow mimicking the changes of light in nature  |  |  |
| <b>7. Connection with Natural Systems</b><br>Such as temperature changes, natural light changes and seasonal changes in a healthy eco system                                    |  |  |

(14 Patterns of Biophilic Design Improving Health & Wellbeing in the Built Environment Terrapin Bright Green 2015)

The 14 Patterns give people the opportunity to follow these principles, they can be applied in different interior and exterior environments giving users a flexible approach to implementing biophilic design principles.

# Biophilic Design Principles.

As you can see in Table 1 Biophilic design can be split into 3 different areas. These are direct connections with nature, indirect connections with nature and spacial features which will be discussed in more detail.

## DIRECT CONNECTIONS.

Firstly direct connections with nature. These are physical features such as views of nature, green walls and water. One of the primary principles of biophilic design is maximising natural light, it is vital to our wellbeing and health and there are many reports including Human Spaces The Global Impact of Biophilic Design in the Workplace Report (2015) showing that by having exposure to light we have improved concentration and performance levels.

A number of different studies have been carried out to show that by having a visible connection to natural views and greenery, stress levels can be reduced and recovery rates improved. An example of this is a study carried out by Brown, Barton and Gladwell (2013) exploring connections between viewing natural scenes and stress recovery. They showed a range of contrasting natural and urban scenes to candidates in a slideshow and asked them to imagine being in that environment. They then carried out mental and psychological assessments such as measuring blood pressure and heart rates. The results suggested that viewing scenes of nature could aid recovery as it had a positive effect on the group's heart rate and nervous system, they also discovered it enhanced self esteem and improved people's moods. In the human spaces report The Global Impact of Biophilic Design in the Workplace (2015) the research showed that a person's well being can improve by 15% in environments with these features. Green walls can also improve air quality which helps concentration levels and can improve acoustics reducing distractions (Human Spaces The Global Impact of Biophilic Design in the Workplace Report 2015).

An example of a designed environment with a visual connection to nature is Maggie's Centre in Lanarkshire Scotland designed by architects Reich and Hall in 2011. The building is a cancer care centre designed by architects focusing on using biophilic design principles to aid recovery and create a restorative environment to improve health and wellbeing.

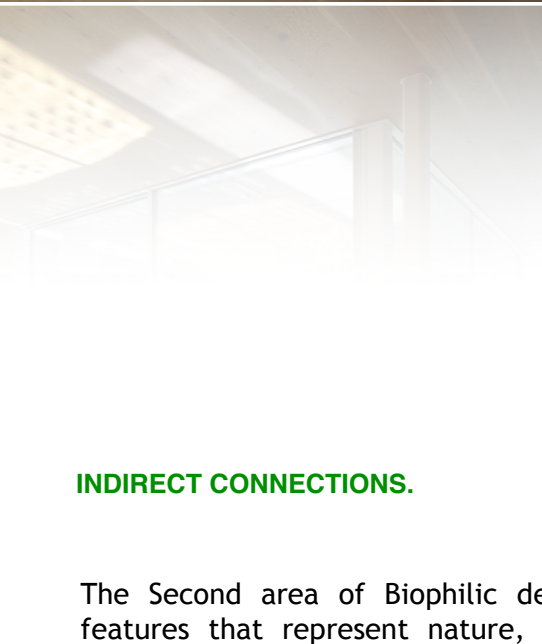
Maggie co-founder Charles Jencks believes that by designing centres incorporating these principles it can have a positive effect on the recovery of patients. Modern day medical facilities are often windowless, stuffy, grey sterile environments. If architecture or our interior surroundings were going to aid our recovery in anyway it certainly wouldn't be incorporating these features. Jencks says "we need medical environments to cure us but we also need to feel like people again rather than patients" (Charles Jencks The Guardian 2010). The design principles they have used in many of the Maggie's centres are relatively simple but by increasing the natural light, increasing the space and openness, using views onto nature and creating pockets of private space they have designed centres focusing on people's sensory requirements and something a world away from traditional hospital environments.



(Maggie's Centre Lanarkshire [www.dezeen.com](http://www.dezeen.com))

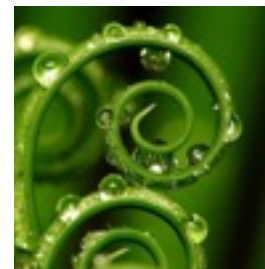


The Lanarkshire Maggie's centre is built on the estate of the Monklands general hospital, the designers have created a boundary using perforated walls creating texture and a degree of separation from the main hospital whilst still offering a connection with the surrounding greenery. Neil Gillespie of Reich and Hall architects said that "at its heart, the design of Maggie's centre is simply a tale of enclosed gardens" (Neil Gillespie Dezeen 2014). The building has been designed as a series of different internal and external connected spaces. The effect of freedom has been created by using large open areas with large windows and external views, they have also created smaller safer environments for privacy and by using obscured views the user feels a sense of anticipation and is enticed to move deeper into the building. By offering a range of different open and enclosed spaces they are replicating the natural environment. Courtyards have been used throughout to bring in natural light and provide covered external access. Perforated light catchers have been used to enhance the light and create different light and shadow patterns that naturally occur in nature. Throughout the building natural materials, textures and colours have been used such as blonde Finnish birch on the walls and lime oak flooring creating a calm and tactile space. There is limited research on how natural materials can impact our health. Tsunetsugu, Miyazaki & Sato 2007 carried out research on the physiological effects of forest environments the study suggested a space with a larger ratio of wood had a more comfortable atmosphere and could help relax the body, they observed decreases in blood pressure and pulse rate so this could be beneficial if used in a restorative environment.



## INDIRECT CONNECTIONS.

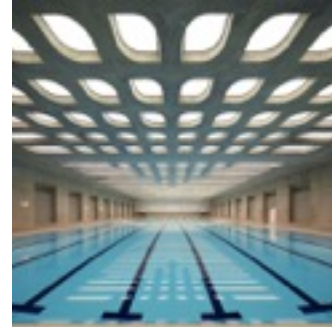
The Second area of Biophilic design is indirect features that represent nature, such as natural materials, colours, forms and patterns. A space designed with reference to natural forms, patterns and textures can feel comfortable and create interest. Terrapin's report states that we have a visual preference for organic and biomorphic forms, they provide representational design elements that allow us to make connections to nature (14 Patterns of Biophilic Design Improving Health & Wellbeing in the Built Environment Terrapin Bright Green 2015). It's shown that by using these forms we can create a preferred environment that can aid cognitive performance and reduce stress.



The representation of nature can be used in two ways. This could be as a decorative part of the design or within the design of the structure itself. Many architects have taken inspiration from nature to create more organic forms of architecture. Doris Kim Sung an architect who previously studied biology and is inspired by the biological and natural world and architect Zaha Hadid, renowned for her modern organic concepts often generating controversy with her designs, most recently the £1.3 billion olympic stadium in Tokyo being scrapped due to rising costs and the criticism she received for the working conditions for the 2022 World cup design in Qatar which resulted in a number of workers dying.



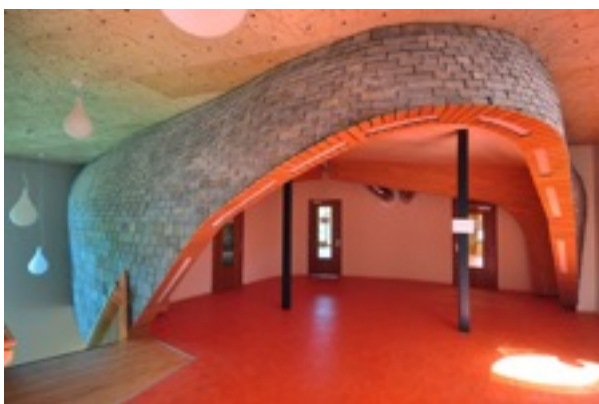
(London aquatics centre [www.designboom.com](http://www.designboom.com))



([www.archdaily.com](http://www.archdaily.com))

Zaha Hadid describes the London Aquatics centre designed for the 2012 olympics as “a concept inspired by the fluid geometry of water in motion, creating spaces and a surrounding environment in sympathy with the river landscape of the olympic park” ([www.designcurial.com](http://www.designcurial.com)) The building’s roof has been designed to replicate a wave she has also used natural forms and patterns throughout the interior of the building.

It is also seen as beneficial to create a material connection with nature by incorporating natural materials with little or no processing into our designs, this can help create a warm and tactile space simulating the natural environment. An example of this in practice is Mare college, a school based in the Netherlands designed by 24H architects 2013. They used natural forms and materials to create a healthy, warm and stimulating learning environment.



(Mare college [www.archdaily.com](http://www.archdaily.com))





## SPACIAL FEATURES.

Finally spacial features that replicate the natural environment such as wide open spaces or more private closed areas for refuge. The 14 patterns of Biophilic design by Terrapin define the nature of space as four different attributes. These are Prospect, Refuge, Mystery and Risk.

Prospect is defined as a view over a distance. This is used to create an open environment offering the user a sense of freedom whilst maintaining a sense of control especially in environments they are unfamiliar with. This has been proven to reduce stress (Grahn & Stigsclotter 2010), fatigue (Clearwater & Coss 1991) and improve comfort levels (Herzos & Bryce 2001).

The second attribute of the nature of space is Refuge, this is defined as creating spaces for privacy and enabling users to withdraw from the main environment. Creating this the user feels protected and safe, this can be an important design element as people can retreat and restore themselves without feeling disjointed from the rest of their surroundings. Edward O Wilson (The Theory, Science & Practice of Bringing Buildings to Life Biophilic Design Stephen R Kellert 2008) discusses why Refuge is so important to humans, if people chose their surroundings they would instinctively choose environments with a combination of features including a retreat to live in and a prospect of land to forage from. Its thought this desire comes from people wanting to live in the environment humans have evolved in. It is one of our natural coping mechanisms that if we are in a large open space we seek food, water and a safe place to retreat and be protected. These desires are continued today in our current lives.

The third element is Mystery, this is the promise of more and can be created through partially obscured views and suggestions of space to entice the user to travel further into the building. This feature comes from people's desire and basic need to explore and understand (Kapla and Kapla 1989). The final attribute is Risk defined by Terrapin Bright Green as 'an identifiable threat coupled with a reliable safeguard'. By incorporating Risk as an element of design the user can feel exhilarated and intrigued. It can also improve peoples attention and arouse curiosity. An extreme example of how Risk can be used in architecture is Brewster's discovery walkway Canada, this is a cantilevered glass viewing platform over a glacial valley designed by Sturgess architects built in 2014. It creates an exhilarating experience for the user with elements of risk and danger whilst remaining safe.



(Brewsters Discovery Walkway [www.architectmagazine.com](http://www.architectmagazine.com))

**Prospect.**  
**Refuge.**  
**Mystery.**  
**Risk.**

# Benefits of Biophilic Design.

There are 3 main areas where we can benefit from Biophilic design principles in our environments. These are improving our cognitive functions such as our ability to learn, our level of creativity and our performance. Secondly our psychological health and well being can have a positive response through reduced stress levels and balanced emotions. Finally our physiological health and well being can improve as reduced stress levels mean relaxed muscles, lower heart rate and blood pressure. Combined these features lead to a more positive experience improving our performance, well being and happiness.

## OFFICES.

The Global Human Spaces Report (2015) states that a key factor in maintaining and improving our wellbeing is by reducing our stress levels and the research carried out shows that by having a visible connection with nature this is possible. The report shows that an employee's wellbeing can increase by up to 15% by working in an environment using natural elements and connections to nature. Organisations that provide environments incorporating Biophilic design principles have seen an improvement in employee productivity, creativity and satisfaction with tangible results such as lower absenteeism and staff turnover. An example of this is the Google headquarters in California, currently this project is in progress with a predicted completion date of 2024 designed by Bjarke Ingles and Thomas Heatherwick.

The concept for this design was to create lightweight block like structures that could be moved around rather than a permanent structure. The architects wanted to reflect Google's innovation and create the best possible environment for generating ideas and embodied this in their design ([www.big.dk](http://www.big.dk)). The building was designed with translucent canopies to maximise natural light, improve ventilation and control the climate, aiming to blur the inside and outside world. The offices are built on a campus incorporating bike paths surrounded by trees and greenery. The designers and client want it to be accessible not only to employees but also people living in the surrounding area.

**Employees wellbeing can increase by up to 15% by working in an environment with connections to nature.**  
(Global Human Spaces Report 2015)



(Google Headquarters [www.big.dk](http://www.big.dk))



(Ljubljana Chamber of Commerce and Industry  
Slovenia [www.humanspaces.com](http://www.humanspaces.com))

The Global Human Spaces report also states that workers in office environments incorporating natural elements, views and light are 6% more productive. People's creativity can also be influenced by their surroundings, the report states a person's creativity levels can improve by 15% in offices with natural elements included in their design. It is clear from the evidence that by using Biophilic design principles in office environments organisations can benefit from an increase in productivity, creativity and employee satisfaction, however many companies are reluctant to implement change due to high costs and the difficulty of implementing these principles as retrofit. Larger companies such as Google and Amazon are acting on the findings but to be successful the ideas need to be accessible and cost effective for smaller businesses and organisations to implement. For an organisation to see some improvements it could be as simple as introducing some greenery and indoor plants, as employees have stated this factor alone makes the workplace more desirable and helps create a calmer environment (The Global Human Spaces Report 2015).

## HEALTHCARE.

So why is biophilic design so important in society today, as the world's population continues to grow and our environment becomes more urban we must look at embracing biophilia not only for our health and wellbeing but also for the financial and economic benefits we can gain.

We are now a society so used to spending time indoors that we have lost our connection with nature and as a result of the disconnect widening we are seeing a rise in stress levels, mental health issues and cardiovascular related illnesses. (Biophilic Design Theory, Science and Practice of Bringing Buildings to life Stephen R Kellert 2008). All these factors can have a detrimental effect on our economy, for example businesses could experience reduced productivity levels due to reduced employee satisfaction. They could also see an increase in staff turnover and absenteeism due to poor health leading to higher staff costs and business expenses. The increase in our poor health will continue to put stress on the NHS and our medical services all leading to higher costs and strain on the economy. It seems for organisations to take biophilic principles on board they need to see tangible benefits and monetary savings, however maintaining our connection to nature and our surrounding environment can have many more psychological and physiological benefits.

# 15%

increase in creativity in  
offices with natural  
elements.

# Improve recovery rates. Reduce medication. Shorter Stays.

(Roger S Ulrich)



Studies by researchers such as Roger S Ulrich have shown that hospitals designed with biophilic principles have seen improvements in the recovery rates of patients, reduced medication and shorter stays. An example of how this has been put into practice is the Crown sky gardens at Chicago's children hospital 2013.

The garden sits on the roof of the hospital creating an oasis and a positive distraction for staff, patients and visitors. It can help reduce stress and increase satisfaction. Architects Mikyoung Kim designed the space to maximise the amount of natural light and emphasise the clear views of the city skyline. They have done this by creating a surrounding glass wall and by using the biophilic principles of prospect and refuge, the area can have a positive physiological effect which would be beneficial in such an emotional environment.

Natural materials have been used throughout the design in the form of locally sourced stone, bamboo and reclaimed timber, they have also used water to help create a tranquil environment for contemplation. In an environment like a children's hospital it is important to have an area to escape the stress for all involved, where people can feel rejuvenated and return to their recovery or supporting a patient with a more positive outlook.

In the UK we need to start incorporating the use of biophilic principles in the development of our hospitals and healthcare facilities. There is evidence based research by Ulrich 2005 and Sherman et al 2005 suggesting how these elements such as natural light and views of nature in healthcare settings can help patients, staff and visitors. The effect of nature and exposure to sunlight can help reduce blood pressure, improve patient recovery and reduce their length of stay. This can lead to financial and economic benefits such as reduced costs of patient care and lower staff turnover due to increased employee satisfaction.



(Crown Sky Gardens  
[www.Humanspaces.com](http://www.Humanspaces.com))

# Education.



Another area that could see many benefits and improvements by adopting these principles is education. It's vital to give children the best start in life and instil these principles in their mindset from an early age. We must work at maintaining their connection with nature and the outdoors so it doesn't disappear completely in our ever increasing urban surroundings.

There have been many studies carried out on how important it is for the younger generation to have access to outside environments. The Last Child In The Woods by Richard Louv discusses the ever increasing divide between children and the outside environment and the implications this can have on a "nature deficit" generation. This research links the lack of contact with nature to the rise of obesity, attention deficit disorders and depression. As the majority of children worldwide now live in an urban environment it is increasingly important for us to understand the impact this can have on childhood development and how we can look at making positive changes to children's surroundings. Children are spending more time indoors with increased homework, more time spent on computers and parents no longer feel secure with letting children play outside due to increased risks such as traffic and other dangers. Our society must look at new ways to incorporate healthy lifestyles into their built environment, it seems to make sense to do this in education facilities where children spend most of their time and are so open to learning.

We need to look at addressing the problem of a sedentary lifestyle in early childhood to establish good habits in young children. By instilling a love of nature and natural environments in young children they can continue their respect for the planet into adulthood which could create a generation with a desire to tackle environmental issues such as global warming and reducing their carbon footprint to protect the planet. Kellert states that children are born as "biophilic beings" and have an inborn curiosity for learning from the natural world (Biophilic Design Theory, Science and Practice of Bringing Buildings to Life Stephen R Kellert 2008) During early childhood, sensory impact is the primary mode of learning so it is very important that children have direct experiences with nature, it's processes and materials. This stage of a child's life can be the most important for developing a platform for the future. We as adults have already become urbanised and place less emphasis on the importance of having a connection with nature we must be aware not to pass our negativity to the younger generation. Hopefully by attempting to tackle this issue in the early stages we can stop the pattern repeating itself and create a generation that learns to appreciate and respect the world they live in.

So what are some of the negative effects our children are experiencing from spending most of their time in urban environments and how can we combat these? As discussed in biophilic design the theory, science and practice of bringing buildings to life by Stephen R Kellert, a study was carried out in the US on the effect of obesity with frightening results suggesting a large proportion of children born today may die before their parents. These negative impacts are starting to effect younger children with more than 10% of 2-5 year olds being categorised as obese in the US and 20% as overweight (Ogden at al 2002). It is thought that this is due to a lack of outdoor physical activity.

# 1 in 10 children are obese when they start school

(Health & Social care information centre)

St Ninians a school in Scotland encourages pupils to walk or run a mile a day in a bid to improve their fitness and focus their minds. A number of schools have already adopted the scheme in an attempt to tackle obesity in younger children. According to figures from the Health and Social Care Information Centre 1 in 10 children are obese when they start school.

Research is yet to be carried out on the results of the study but the school doesn't have any problems with obesity, the children enjoy it and seem happier and staff say they settle into lessons faster. It is recommended that children spend at least an hour a day being active this appears to be a simple solution that could be introduced as a step towards improving their lifestyles and showing the children how important exercise and outdoor activity is from an early age. A study by the Economical and Social Research council has shown that a lack of contact with nature can have an impact on cognitive development including language development, problem solving and decision making. One of the key findings from the research found that children in the UK have fallen behind in their development compared to 15 years ago. We need to ask ourselves why this is happening and what the main differences are in society today. One of the major differences is that children are much less likely to be playing outside so they lack the experimental hands on playing skills needed for development.



(St Ninians [www.dailymail.com](http://www.dailymail.com))



# Research.

As a starting point to combating the “nature deficit” generation we need to understand people’s opinions and how much they are aware of the problematic outcomes that can come from a lack of outdoor contact.

I discussed some factors with a small group of parents and these are the findings. I asked the group if they thought it was important for children to have a connection with nature and everyone agreed it was. A few examples of answers included that the parents thought it was important to teach the children about the world they live in, they wanted children to engage with nature, have more physical activity and be able to explore tactile outside environments and learn from them. We discussed what sort of factors would determine their nursery or school of choice to establish how important people thought outside learning and sustainability was. All members of the group stated outdoor facilities played a part in their decision but sustainability and eco principles did not feature at all. However when we asked if a school was sustainably designed and had eco principles would it encourage them to send their children there the majority said yes as long as the other basic factors were met. We discussed what the group would change in their current education facility, a few answers given included larger windows, more natural leafy areas, more light, increased space and open environments, consistent outdoor access and different outdoor spaces such as eating and planting areas.

We asked if the group liked the idea of an outdoor classroom and what they thought the children could gain from this. All parents agreed an outdoor classroom would be beneficial, they wanted their children to be close to nature and given the opportunity to experience the elements and have access to fresh air and natural light. They thought the children would become more mindful of their surroundings and learn about the environment enabling them to gain awareness of themselves and how they fit in to the world around them. They suggested the children could gain more freedom and the opportunity to explore their surroundings independently leading to improved confidence. However some parents did express concerns about how practical it would be to maintain a sense of order and reduce distractions.

The final point we discussed was how they rated certain factors and the impact they could have on a child’s learning the results are shown in table 1.

What factors at school/nursery do you think would help improve your child’s learning?

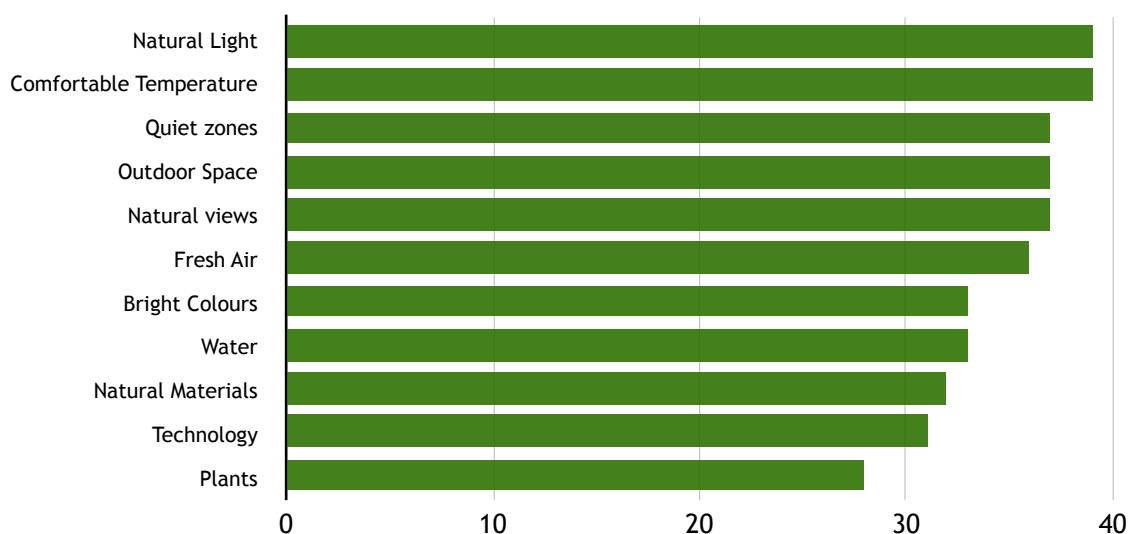


TABLE 1.

## Findings

Our findings from this small discussion group show that people do think it's important for children to have a connection with nature and be given the opportunity to learn outside. However until prompted sustainability and eco principles didn't feature on their list of factors determining their school or nursery of choice although they did say it would 'encourage' them to send their children to that facility.

A lot of the factors the parents would change at there current education facility sit alongside the biophilic design principles and the chart shows the importance they place on specific design features.

I think primarily parents are focused on providing their children with the best teaching environment available to them based on location, reputation, ofsted report and facilities so it's down to our government and education system to embrace biophilic design principles, sustainability and eco principles to make children and parents more aware of their importance alongside all the basic features they expect from an education facility.



(Paul Chevallier School [www.Dezeen.com](http://www.Dezeen.com))





# Benefits of Biophilic Design in Education.

A more human centred approach to design would improve the overall experience for staff and students in the classroom and could have many tangible benefits including an improvement in attendance by 3.5 days a year (Niklas & Bailey 2006), improved test results by 5-14% (Niklas & Bailey 2006) and increased learning speeds of up to 26% (Wells & Evans 2003) through increased exposure to daylight alone. It's suggested that by incorporating views onto nature such as a courtyard or simply a window box, it improves mental function and improves memory (Grahn at al. 1997), studies have also shown reduced symptoms of ADHD in younger children. A report from the Human Spaces website written by Oliver Heath a well known architect, interior designer and ambassador for biophilic design discussed trials that have been carried out researching the effect plants can have in classrooms with results showing improved performance of 10-14% in maths, spelling and science. I recently attended Green build exhibition with a talk by Oliver Heath, he discussed how the principles can be used in education environments and the importance of recognising that it is not just the students that benefit from an improved work environment but also the staff and teachers. He discussed research that shows pupils attention capacity can be restored when they engage with nature. This could lead to reduced distractions and improved concentration levels.

By integrating these design principles into educational settings it could not only benefit the institution but the economy as a whole. With rising costs of education we could see reduced consumption costs by being more energy efficient, reduced staff costs due to lower staff turnover, reduced sickness levels and improved job satisfaction. It could also benefit the economy by improving the overall experience of education so people want to spend more time in education and are more likely to continue into further education.



(School of the Arts, Singapore)

## Case Studies.

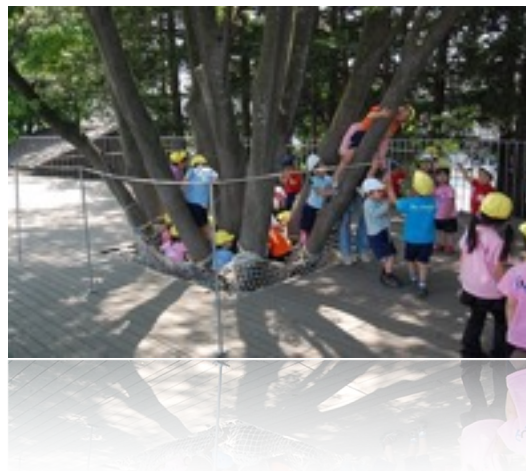
St Mary's infant school in Oxfordshire by Architects Jessop and Cook is an example of how biophilic design can be incorporated into an education facility. It is a relatively small scale and simply designed space but has many biophilic design principles. One of the key features is the use of natural light, with studies suggesting an increased learning speed of 20-25% (Heschong 1999) this is one of the most beneficial attributes. They have also maximised the views of nature, designed a range of different spaces including interior and exterior play areas and have used a palette of natural materials, colours and textures. Acoustic panels have been used to reduce noise distractions and help create an effective learning and teaching environment for students and staff.



(St Mary's Infant school [www.archdaily.com](http://www.archdaily.com))



(Fuji Kindergarten [www.architonic.com](http://www.architonic.com))



Another interesting example is the Fuji Kindergarten outside Tokyo built in 2007 designed by Tezuka Architects. The kindergarten was designed as a spiral shaped building surrounding a large old zelkova tree intertwined with nature and other trees growing through the classrooms and ceilings.

They have created a communal climbing area for the children so they can integrate with each other and nature. The building has no boundaries between inside and outside and remains open for most of the year giving the children the freedom to explore. It is a tradition in Japanese architecture to welcome nature and Fuji kindergarten has embraced this principle. The shape of the building ensures the children receive lots of natural light and air with clear views onto nature and open sky. The circular shape also encourages the children to run on the roof top and climb trees, in his TED talk architect Takaharu Tezuka states that the children at the kindergarten have good athletic abilities and run large distances due to the shape of the building and the access to space reinforces the importance of being active from a young age. The classrooms are created by dividing the space with wooden blocks so they can utilise the open space and encourage children to work together or create more private zones if required.

The UK need to re-evaluate how we currently view our education facilities. Why are all our school buildings similar? Do children need to be in a traditional classroom setting? Is this the most effective way our children can learn? We can look towards other countries for alternative education settings and teaching methods.

“Udeskole” is a Scandinavian concept meaning “outdoor school”. In Scandinavia it is compulsory for education activities to be carried out in an outdoor environment on a regular basis. Teaching outside gives pupils the opportunity to work together and helps them understand and appreciate the environment and their surroundings. The Forest school ethos is an integral part of Scandinavia’s curriculum however in the UK it is a relatively new concept. It gives children the opportunity to learn through hands on woodland experiences and is gaining popularity across the UK. Forest schools were pioneered by Bridgewater college in 1993 after a team visited Denmark on an exchange trip and they were inspired by the countries outside learning philosophy, on their return they set up the first forest school in Somerset. The Forest school association charity has since helped 12,000 teachers and professionals take the relevant training to be qualified to work in forest schools and they are gradually appearing across the UK.

During my research I also came across Vittra, an international learning program with schools based in Sweden. They view education differently and focus on individual development plans for all students. They wanted to create a challenging learning environment without classrooms using interactive sessions and teaching to prepare the children and focus on building confidence, self awareness and creativity. Rosan Bosch is the Creative Director of Rosan Bosch Studio, she specialises in designing inspiring school environments and came up with the concept behind the interiors of the Vittra schools. She created an interior based around the schools principles, so instead of conventional classrooms interaction is key and different learning zones were developed to accommodate the alternative teaching styles.



(Vittra [www.rosanbosch.com](http://www.rosanbosch.com))

# Final Thoughts.

The conservative party are looking at building at least an extra 500 schools for 270,000 children across the UK. They are looking at standardising and reducing the cost of building new schools with a 'flat packed' approach but this has received a lot of criticism. The Royal Institute of British Architects have expressed concerns that this approach would affect the quality of teaching and the students well being. Education secretary Michael Gove's approach has received negative reactions claiming that it is too restrictive and there is no consideration for teaching professionals and students well being, comfort or future sustainability.

As this report has indicated the classroom could be one of the most influential environments for young children, with effectively designed education facilities and by integrating biophilic principles into our education system alongside the current curriculum we could enhance student performance whilst improving their health and well being. By educating our children about the environment and integrating them with nature, they would also gain more appreciation for their surroundings and grow up willing to tackle environmental issues and reduce their carbon footprint.

This report reinforces the importance of creating innovating and inspiring design concepts by incorporating biophilic principles into education facilities to benefit future generations.



# Bibliography

## Journals -

Kellert, S. and Calabrese, E. 2015. The Practice of Biophilic Design.

[www.biophilic-design.com](http://www.biophilic-design.com)

Terrapin Bright Green LLC. 2012. The Economics of Biophilia.

[www.terrapinbrightgreen.com](http://www.terrapinbrightgreen.com)

Terrapin Bright Green LLC. 2014. The 14 Patterns of Biophilic Design.

[www.terrapinbrightgreen.com](http://www.terrapinbrightgreen.com)

Human Spaces 2015 : The Global Impact of Biophilic Design in the Workplace

## Books -

Stephen R. Kellert, Judith H. Heerwagen, and Martin L. Mador 2008. Biophilic Design The Theory, Science, and Practice of Bringing Buildings to Life.

Richard Louv Last Child in the Woods (2008)

## Websites -

[www.fallingwater.org](http://www.fallingwater.org) (accessed on 13/11/2016)

<https://www.maggiescentres.org/our-centres/maggies-lanarkshire/> (accessed on 13/11/2016)

<https://www.maggiescentres.org/our-centres/maggies-lanarkshire/architecture-and-design/>  
(accessed on 13/11/2016)

<http://www.dezeen.com/2014/10/20/reiach-and-hall-architects-maggies-centre-lanarkshire-walled-gardens/> (accessed on 13/11/2016)

<http://www.theguardian.com/artanddesign/2010/may/06/maggies-centres-cancer-architecture>  
(accessed on 13/11/2016)

<http://www.theguardian.com/sustainable-business/blog/maggies-cancer-care-centres-healthcare-architecture>  
(accessed on 25/11/2016)

<http://www.telegraph.co.uk/lifestyle/wellbeing/healthadvice/11720315/Theres-so-much-more-to-cancer-treatment-than-medicine.html> (accessed on 25/11/2016)

<http://www.archdaily.com/tag/doris-kim-sung> (accessed on 10/12/2016)

<http://www.zaha-hadid.com> (accessed on 16/12/2016)

<http://www.arcspace.com/features/zaha-hadid-architects/> (accessed on 10/12/2016)

<http://www.theguardian.com/artanddesign/zaha-hadid> (accessed 6/01/2016)

<http://www.dailymail.co.uk/news/article-3247449/Architect-Zaha-Hadid-storms-BBC-interview-awkward-questions.html> (accessed 6/01/2016)

<http://www.archdaily.com/480990/zaha-hadid-on-worker-deaths-in-qatar-it-s-not-my-duty-as-an-architect> (accessed on 6/01/2016)

<http://www.designboom.com/tag/zaha-hadid/> (accessed on 6/01/2016)

<http://www.designcurial.com> (accessed on 7/01/2016)

<http://www.archdaily.com/392465/marecollege-24h-architecture> (accessed on 7/01/2016)

<http://www.dezeen.com/2011/03/11/brewsters-discovery-walkway-by-sturgess-architecture/>  
(accessed on 8/01/2016)

[http://www.architectmagazine.com/technology/take-in-a-deep-breath-with-the-view-on-the-glacier-skywalks-glass-floor\\_o](http://www.architectmagazine.com/technology/take-in-a-deep-breath-with-the-view-on-the-glacier-skywalks-glass-floor_o) (accessed on 8/01/2016)

<https://www.brewster.ca/activities-in-the-rockies/brewster-attractions/glacier-skywalk/#/0>  
(accessed on 8/01/2016)

[http://www.slate.com/blogs/future\\_tense/2015/02/27/googleplex\\_google\\_plans\\_new\\_headquarters\\_in\\_mountain\\_view\\_s\\_north\\_bayshore.html](http://www.slate.com/blogs/future_tense/2015/02/27/googleplex_google_plans_new_headquarters_in_mountain_view_s_north_bayshore.html)  
(accessed on 9/01/2016)

<http://www.bloomberg.com/news/features/2015-05-07/google-s-new-campus-architects-ingels-heatherwick-s-moon-shot> (accessed on 9/01/2016)

<http://www.big.dk/#projects> (accessed on 9/01/2016)

<http://www.dezeen.com/2016/01/08/big-wilson-secondary-school-arlington-virginia/> (accessed on 11/01/2016)

<http://www.dezeen.com/2015/02/27/big-and-heatherwick-unveil-vibrant-new-neighbourhood-for-googles-california-hq/> (accessed on 11/01/2016)

<http://humanspaces.com/case-studies/crown-sky-garden-mikyong-kim-design/> (accessed on 11/01/2016)

<http://www.theguardian.com/education/2015/sep/28/daily-mile-school-st-ninians-stirling-scotland> (accessed on 12/01/2016)

<http://www.jessopandcook.co.uk/projects/education/st-marys-infant-school/> (accessed on 12/01/2016)

[www.dezeen.com/2013/08/07/st-marys-infant-school-by-jessop-and-cook-architects/](http://www.dezeen.com/2013/08/07/st-marys-infant-school-by-jessop-and-cook-architects/) accessed on 12/01/2016)

<http://www.designtrend.com/articles/3813/20130412/worlds-best-classroom-japan-fuji-kindergarten-wraps-around-100-year.htm> (accessed on 13/12/2016)

[https://www.ted.com/talks/takaharu\\_tezuka\\_the\\_best\\_kindergarten\\_you\\_ve\\_ever\\_seen?language=en#t-503486](https://www.ted.com/talks/takaharu_tezuka_the_best_kindergarten_you_ve_ever_seen?language=en#t-503486) (accessed on 13/12/2016)

<http://www.designcurial.com/news/biophilic-design-and-architecture---10-of-the-best-biophilic-buildings-4527750/www.eco-schools.org.uk> (accessed on 14/01/2016)

[www.richardlouw.com/books/last-child](http://www.richardlouw.com/books/last-child) (accessed on 13/11/2016)

<https://www.childrenandnature.org/2013/02/12/udeskole-in-scandinavia-teaching-learning-in-natural-places/> (accessed on 14/01/2016)

<http://teachout.ku.dk/om-projektet/beskrivelse/description.pdf><http://www.theguardian.com/teacher-network/teacher-blog/2013/mar/22/school-design-architecture-buildings-learning-live-chat> (accessed on 14/01/2016)

[www.vittra.se/english/](http://www.vittra.se/english/) (accessed on 14/01/2016)

[http://www.rosanbosch.com/en/projects?projects\\_all\\_args=6](http://www.rosanbosch.com/en/projects?projects_all_args=6)

[www.oliverheath.com](http://www.oliverheath.com)[www.interface.com](http://www.interface.com)

<http://www.humanspaces.com>

<http://www.heatherwick.com>

[www.biophiliaeducational.org](http://www.biophiliaeducational.org)

[www.terrapinbrightgreen.com](http://www.terrapinbrightgreen.com)

[www.ukgbc.org](http://www.ukgbc.org)

<http://www.dezeen.com/2013/09/09/school-complex-in-rillieux-la-pape-by-tectoniques/>