

The Role of Sustainable Interior Design Strategies in Increasing Occupant Comfort in Commercial Spaces

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Research Abstract:

Le Corbusier said in the early of this century, that “A House is a Machine for Living in. “In the same way, an office is a machine for working in and a commercial space is a machine for achieving beneficial results in.

To enhance environmental sustainability, a building (especially Commercial Interior) must holistically balance and integrate all three principles — Sustainable Design, Economy of Resources and Life Cycle Design — in design, construction, operation and maintenance, and recycling and reuse of architectural resources. These principles comprise a conceptual framework for sustainable architectural design.

There is an absolute fact that Healthy Building makes and lead to Healthy people so that the research reaches for sustainable interior design strategies that can achieve a number of positive results throughout a company’s operations and culture by enhancing employee health and well-being, by improving learning environments, by increasing occupant comfort using sustainable interior design solutions, elements and furnishing, which enhance public relations, marketing opportunities, customer satisfaction and finally the aesthetic harmony between the building and its natural surroundings.

In line with growing customer demand, the availability of green products is constantly increasing, causing a situation where product quality does not need to be compromised in a search for an eco-friendlier interior.

Key words:

Bio Based – Bio mimicry - Day lighting – Eco-System – Green Power – Sustainability – Strategies – Commercial interior – Eco-friendly – Biophilia.

الملخص:

قال لو كوربوزيه Le Corbusier في أوائل هذا القرن، أن "المنزل هو آلة للعيش فيه". وبالمثل، فإن المكتب هو آلة للعمل فيه و الفراغ التجارى هو آلة لتحقيق نتائج إيجابية فيه.

وبسبب أن غالبية مصممي العمارة الداخلية الآن يوجهون إهتمامهم لتصميم الآلة وليس لقاطنيها و إحتياجاتهم ، فإن غاية البحث هي دراسة أهمية الاعتراف بأن كل حدث من الطبيعة هو "التصميم" للتعايش و التفاعل معه و فيه، وقوانين الطبيعة وُضعت للتعبير عن اهدافنا و مقاصدنا الإنسانية، فيجب أن نتعايش بسلام و نقبل مكاننا فى العالم الطبيعي .

ان التصميم الأخضر ليس شيئاً واحداً فقط ، بل إنه يمس كل جوانب ما لدينا من مصطلحات تقليدية مدرجة في مفردات التصميم المعماري الداخلى مثل، الوظيفة، الجماليات والتكلفة.

ولتعزيز الاستدامة البيئية ، يجب على المبنى (خاصة الفراغ التجارى) أن يوازن بشكل شامل ودمج جميع المبادئ الثلاثة - التصميم المستدام والاقتصاد للموارد وتصميم دورة الحياة - في التصميم والتشييد والتشغيل والصيانة وإعادة التدوير وإعادة استخدام الموارد المعمارية.

وتشمل هذه المبادئ إطارا مفاهيميا للتصميم المعماري المستدام. ويهدف هذا الإطار إلى مساعدة مصممي العمارة الداخلية على إيجاد حلول بدلا من منحهم مجموعة من الحلول. وتهدف استراتيجيات العمارة الداخلية المستدامة إلى فهم كيفية تفاعل المبنى مع البيئات الداخلية و الخارجية المحيطة به.

ليس هناك شك في أن بناء (فراغ) صحي يجعل الأشخاص (قاطنى الفراغ) أصحاء، فيهدف البحث من خلال استراتيجيات التصميم الداخلي المستدام إلى تحقيق عددا من النتائج الإيجابية في جميع أنحاء عمليات الشركة والثقافة ، من خلال تعزيز صحة الموظفين ، والرفاهية ، من خلال تحسين بيئات التعلم ، كذلك من خلال زيادة راحة قاطنى الفراغات باستخدام حلول التصميم الداخلي المستدامة من محددات فراغ و عناصر تأثيث ، مما يعزز العلاقات العامة ، وفرص التسويق ، ورضا العملاء ، وأخيرا الانسجام الجمالي بين المبنى و الطبيعة المحيطة به. فالتصميم يجب أن لا يكون جاذب فقط لرؤية العين، ولكنه دائم، صديق للبيئة، ومُوصل للصحة الجيدة.

الكلمات المفتاحية :

المحاكاة البيولوجية -إضاءة النهار - النظام البيئي - الطاقة الخضراء - الاستدامة - الاستراتيجيات - التصميم الداخلي التجاري - صديقة للبيئة

Introduction:

Le Corbusier said in the early of this century, that “A House is a Machine for Living in “. Similarly, an office is a machine for working in and a commercial space is a machine for achieving positive results in, and because of that most of designers are now designing for the machine and not for people. The research considers to study the importance of recognizing that every event of nature is a “Design” to live within, the laws of nature mean to express our human intention, we must come to peace with and accept our place in the natural world. Green Design isn't just one thing, it touches all of the aspects of what we have traditionally included in the design vocabulary as, function, aesthetic and cost.

There is no doubt that Healthy Building make and lead to Healthy people, so that the research reaches for sustainable interior design strategies that can achieve a number of positive results throughout a company's operations and culture by enhancing employee health and well-being, by improving learning environments , by increasing occupant comfort using sustainable interior design solutions, elements and furnishing , which enhance public relations , marketing opportunities , customer satisfaction and finally aesthetic harmony between the building and its natural surroundings .

On the other side, more and more customers are becoming aware that building's interior should not only be pleasing to the eye vision, but durable, environmentally friendly and conducive to good health. In line with a growing customer demand, the availability of green products is constantly increasing, leading to a situation where product quality doesn't need be compromised in a search for an eco-friendlier interior.

1 - Approaching sustainable specification:

1-1 - The familiar environmentalists' mantra of the (Rs):

It is apparent that we need to reduce our consumption of materials and choose them wisely to mitigate their environmental impact. Comparing the pros and cons of different materials can be bewildering. The familiar environmentalists' mantra of the three Rs – reduce, re-use, recycle – is helpful here. But we should add an extra R, for using renewables, when it comes to specifying building materials. To mitigate the environmental damage associated with materials, the interior designer's priorities must be to first reduce, second re-use and third recycle, while ensuring that any new materials used are renewable. To fully understand whether a material is a sustainable choice, interior designers must consider its environmental impacts at every stage of its life cycle. As well as embodied energy and water, these might include pollution, habitat destruction, and waste and health issues.

Interior designers are usually responsible for selecting all internal materials and finishes, so they are best placed to control the associated environmental impacts. Rather than being a negative constraint, sustainable specification offers vast scope for creativity.

a - Reduce:

Reducing material use can be achieved on a fundamental level by questioning whether certain materials or products are needed at all. Supposing they are required, using materials that are untreated or self-finished, perhaps plywood or exposed brickwork, avoids the need for added finishes such as varnish, paint or plaster. Using materials efficiently is another valid approach: metal could be used as a wide mesh rather than a solid sheet, and timber could be used as a thin veneer to cover a surface using minimal material. Figure (1)



Figure (1) - It is important to consider the environmental impact of the Packaging a product comes in, as well as that of the product itself. Wrapping a material in excessive plastic packaging magnifies its ecological footprint.

<https://issuu.com/greenallianceuk/docs/goodproductbadproduct>

b - Re-use:

Re-using materials includes salvaging demolition waste, using reclaimed materials and ensuring that specified materials can be re-used at the end of the project. Re-using prevents existing materials going to waste in landfill and saves on the embodied energy and water that would have been necessary to produce replacement materials. In practice, re-using is often inextricably linked to reducing, as using existing materials can reduce the need for new ones. Re-using avoids the need for many virgin raw materials and all the environmental problems they cause throughout their life cycle. Figure (2)



Figure (2) -Vintage products include inventive designs, such as this chair by Restore made from a reclaimed supermarket trolley.

<http://atroisblog.blogspot.com/2014/04/trasformazione.html>

c - Recycle:

Recycling is distinct from re-using in that existing materials are reprocessed into a new form. It diverts waste materials from landfill and reduces the amount of virgin resources needed to make new products. Re-using is more effective than recycling because of the extra energy, water and transportation needed for the recycling process. To promote recycling, an interior designer can choose recycled-content products, provide facilities for recycling when the space is in use and ensure that the materials they specify can be recycled at the end of the project's life. Figure (3)



Figure (3) - Here Restore has turned a salvaged bath into a unique sofa.

https://www.dobrzemieszkaj.pl/galeria/wlosy_grzyb_kawa_z_czego_jeszcze_mozna_zrobic_meble,220104-351117.html
chaise longue.

The best scenario is to choose a product covered by a manufacturer take-back scheme, which is becoming common for carpets. Simple products made of single materials will be easier to isolate for recycling than composite products made of several materials fused together. Finishing is also important, as painting or varnishing a material like timber may mean it will not be accepted by a recycling scheme.

d - Renewables:

Interior designers must take care to specify ones that originate from renewable sources. This is valid for both natural and synthetic materials, as synthetic materials rely on natural ingredients. For natural materials, designers should seek plentiful, fast-growing and self-replenishing materials. Abundant tree species include ash and larch. Bamboo and hemp are fast-growing plants. Animal products, such as sheep's wool and alpaca, are self-replenishing. Designers

should avoid potential causes of illegal forest clearance, such as uncertified rubber, the best way is to insist that timber and rubber come from a certified renewable source

‘The best friend on earth of man is the tree. When we use the tree respectfully and economically, we have one of the greatest resources on the earth.’ Frank Lloyd Wright

1-2- Applying Sustainable (Rs) Materials in Commercial Projects:

The research will show here some of the commercial projects using the Sustainable concept, to focus on how the interior designer can apply natural materials in his approach:

A- Astrium Nature Select Shop;

Astrium Nature’s new select shop specializes the company’s philosophical interest in wood as a material embodying growth and renewal. From Astrium’s existing logo, the designer extract an abstract tree able to articulate the different needs for the two labels featured in the shop: accessory designer Hikaru Matsumura on the ground floor, and the menswear line the Viridi-anne in the basement. For Matsumura, the trees act as a display system dramatizing the six meter high space, with mirrored walls multiplying the trees to strengthen the feeling of an abstract forest. Figure (4)

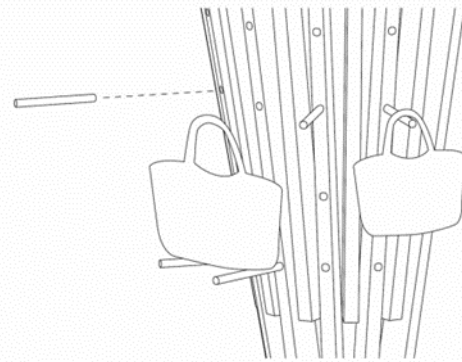


Figure (4) - the designer extract an abstract tree able to articulate the different needs for the two labels featured in the shop: accessory designer Hikaru Matsumura on the ground floor, and the menswear line the Viridi-anne in the basement. <https://www.archdaily.com/105403/astrium-nature-select-shop-popular-architecture/popa-astrium-07>

B - Baya Park offices

The interior designers produced a space that meets the practical requirements of a public reception while providing private meeting spaces, including a nest-like structure influenced by the birds after which the client company is named. The key idea was to build a sculptural, dynamic, fluid form that evokes the Baya nest in a scaled way." The nest is constructed from a curving frame of plywood ribs that narrows as it goes near the ceiling and is clad in strips of pine salvaged from inside shipping containers. Its organic form provides a sculptural presence in the lobby, while the woven surface lets daylight from the adjacent windows filter into the interior. Figure (5). Other references to nature featured in the interior design include a living wall of plants behind the reception desk that reinforces the client's organic branding. A green back-painted glass wall in a separate meeting room continues the natural motif, and complements dark walnut paneling that is used on nearby walls. Figure (6)



Figure (5) - The nest is constructed from a curving frame of plywood ribs that narrows as it approaches the ceiling and is clad in strips of pine salvaged from inside shipping containers. Its organic form provides a sculptural presence in the lobby, while the woven surface lets daylight from the adjacent windows filter into the interior. <https://inhabitat.com/planet-3-studios-weaves-nest-like-meeting-space-with-recycled-pine-wood-strips/>

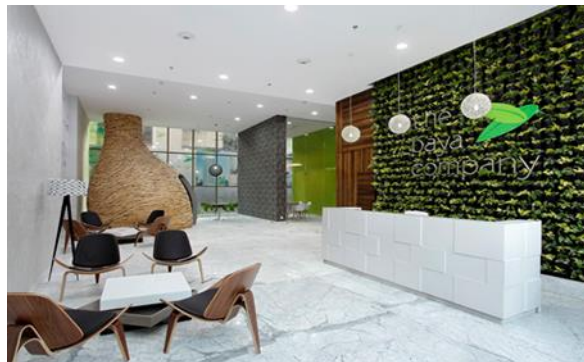


Figure (6) - A living wall of plants behind the reception desk that reinforces the client's organic branding. A green back-painted glass wall in a separate meeting room continues the natural motif, and complements dark walnut paneling that is used on nearby walls. <https://inhabitat.com/planet-3-studios-weaves-nest-like-meeting-space-with-recycled-pine-wood-strips/>

C - Moving Boxes: DIY Modular Cardboard-Recycling Bookcases

The designer Dany Gilles (minimalist designer) use a kit-of-parts approach, raiding recycling bins for usable scrap. The interlocking parts create a system of stable stand-alone book or display shelves that are each structurally independent from the next. Figure (7), also the Smithfield store is made from cardboard packaging figure (8).

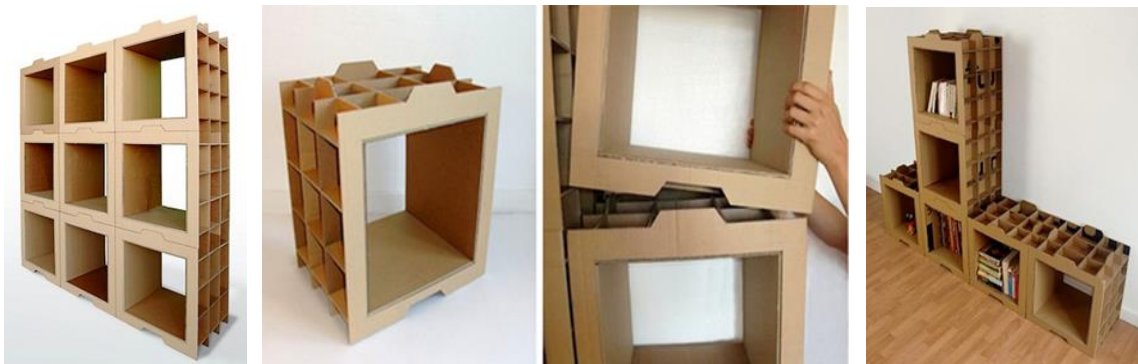


Figure (7) - The interlocking parts create a system of stable stand-alone book or display shelves that are structurally independent from the each other.

<https://apkgk.com/id/com.MakingCardboardCrafts.hamstudio>



Figure (8) - The Smithfield store is made from cardboard packaging, such as these shipping boxes arranged to display shoes. Witty animal sculptures, like the panda head on the wall, have also been fashioned from cardboard.

<https://inhabitat.com/100-recycled-cardboard-interior-is-totally-tubular/>

D - Howies store:

The Bristol shop is the second in casual clothing company Howies' expansion from online and mail-order retailing to high-street shops. The retailer's sustainable approach to business and allows for its anticipated growth. Daily flexibility is provided through multi-use spaces, and changeable furniture and fixtures. The Denim Room, where jeans are displayed on trestle tables and hung from the ceiling rafters, is partly enclosed by glazed walls. This transparency retains a visual connection with the rest of the shop. On the main shop floor, all of the display furniture is either portable or adjustable. Freestanding crates, A-frames, benches and trestle tables are used to display clothes in the center of the space and can easily be moved or removed to create different layouts. Elsewhere, clothes are suspended from metal hangers over the rafters above and can be relocated. Existing materials found on site where they can be reused, including a wall clad in glazed tiles that was uncovered beneath layers of plasterboard. Reclaimed timber from nearby suppliers was used to create the display units, and gives the interior a homely character that suits the Howies brand. Figure (9)

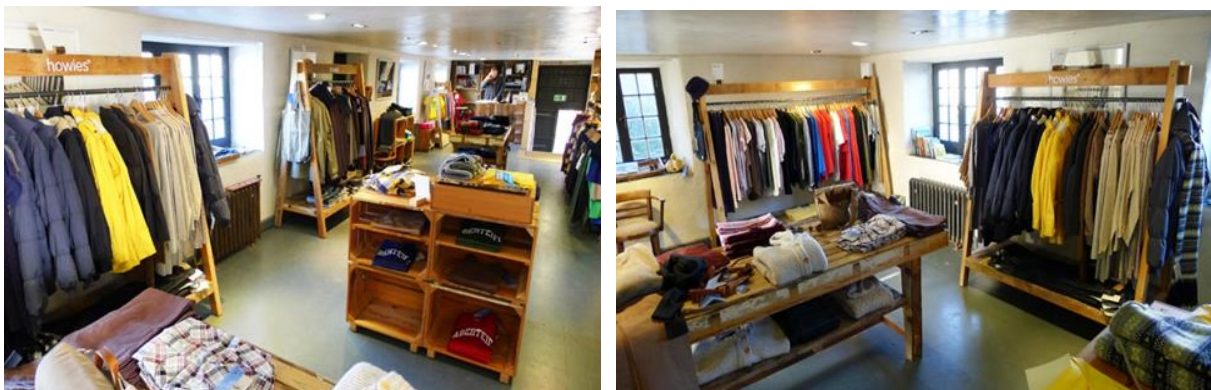


Figure (9) - designed by Remodel - The main shop floor can be reconfigured to allow different layouts. Freestanding display units, including A-frames and crates, are used towards the center of the space. Around the perimeter, horizontal clothes rails connect to a track system. Light fittings are on a ceiling-mounted track system and their angle can be adjusted. Clothing is hung from the ceiling rafters in the Denim Room, using metal hangers that can be moved or removed to suit requirements. Adjustable spotlights are mounted on a track system along the rafters.

<http://www.remoldesign.co.uk/howies-at-home/>

2 - Sustainability and the role of interior designers:

2-1- Changing in the field of interior design:

With our daily lives saturated with talk of climate change, interior designers need to join other construction industry professionals in tackling this and other environmental issues. Building has a significant impact on the environment, and interior projects are of no exception. Fortunately, interior designers – with their focus on refurbishment projects, lighting and materials – are well placed to instigate change. Change can be effected by a combination of relearning lessons from the past and embracing new technologies. There is much inspiration to be taken from traditional buildings and iconic designers from the past few centuries, whose good design inadvertently produced sustainable results. New products, such as LED lighting, prefabricated components and veneers, can be exploited to complement basic sustainable design principles. The results do not need to conform to an ‘eco’ style: sustainability can simply be part of any good design. It is vital that interior designers first consider how to approach designing sustainably. This involves overcoming potential barriers to environmentally conscious design, considering the consequences of design decisions and knowing what questions to ask during the design process. Designers can even opt to use a formal assessment scheme to ensure a rigorous approach. Figure (10)



Figure (10) - In this visualization of Nature Café de la Porte in Amsterdam (Netherlands), RAU architects depict natural materials such as timber dominating the interior, showing a sustainable approach during the design process.

<https://docplayer.net/49180709-Sustainability-in-interior-design.html>

Both for reasons of self-interest and a moral obligation to other species, we need to address these issues. We must act to safeguard our own survival and sanity by ensuring that humans always have access to food, energy, clean water and the natural world. In parallel, we arguably have a duty to protect ecosystems and other species, since we have caused the problems, and we alone have the intelligence, communication skills and knowledge to solve them. The key to solving these problems is sustainability, or meeting today’s needs without compromising those of the future. In the construction industry, this needs to be brought about through sustainable design, which applies this principle to all design decisions. Interior designers in particular can help, as they often work on renovation and residential projects, carefully select materials and finishes, and frequently choose lighting and appliances. Most interior designers are failing to embrace sustainable design, so progressive interior designers must take action to catch up with other designers in the construction industry. Figure (11)

While sustainability has social, economic and environmental aspects, given the construction industries huge impact on the environment, designers can easily make a positive difference to environmental problems through their design choices.



Figure (11) - Today's interior designers can take advantage of the latest technology to produce a sustainable design. Here, prototype light-emitting wallpaper by Jonas Samson uses high-tech illuminated sheets to make a product that efficiently performs both a decorative and a practical function.

<https://docplayer.net/49180709-Sustainability-in-interior-design.html>

2-2- A Sustainable Approach:

Crucially, an interior designer must learn to ask the right questions at the start of a project, - scrutinizing the purpose of a design.

- Making informed choices about energy and water systems, materials and construction methods that acknowledge the whole life cycle of the design.
- Looking at each stage of the life cycle helps the designer to see the bigger picture.
- recognizing the long-term environmental impacts.
- making more sustainable design decisions.

To create a successful sustainable interior, the designer needs to ask themselves the right questions throughout the design process and assess all the consequences of their decisions over the project's life cycle. The following, diagram (1), form a prompt to help interior designers work through the design process and ensure that all stages of the life cycle have been considered with a view to developing a sustainable design. The questions help the interior designer to ensure that sustainability is not only thoroughly considered, but incorporated appropriately, with due regard to project-specific factors. The questions can be used as an alternative to, or in support of, more sophisticated life-cycle assessment methods. They are generic and can therefore be applied to any type of project.

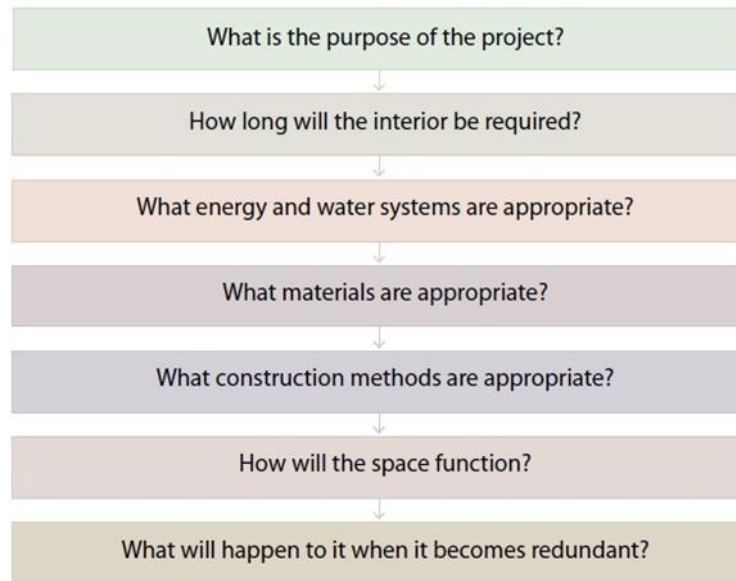


Diagram (1) - The questions help the interior designer to ensure that sustainability is not only thoroughly considered, but incorporated appropriately, with due regard to project-specific factors. The questions can be used as an alternative to, or in support of, more sophisticated life-cycle assessment methods. They are generic and can therefore be applied to any type of project.

2-3- The Biophilic Design:

The human mind evolved in a sensory-rich natural environment. Light, sounds, odors, wind, vegetation, water, and animals provided the context for learning and, ultimately, created the capacity for humans to modify nature and build their own habitats, often at the expense of the natural world.

Understanding the deep-seated interdependence with nature and its consequences for the environment and for human well-being is the focus of a new project under way at Yale University. The project has three primary goals:

- To identify critical **biophilic** features and attributes of buildings and landscapes.
- To document the emotional, social, cognitive, health, and spiritual benefits of living and working in **biophilic** buildings and spaces.
- To develop a design methodology /system that integrates **biophilic** experience with sustainable building design and landscape practice.

As noted in the third goal, **biophilic** design is intended to work in harmony with sustainability. However, as currently practiced; the benefits from sustainable design come primarily from risk reduction associated with improved indoor environmental quality, including energy and resource efficiency and minimization of waste and pollution.

Biophilic design, while embracing risk reduction strategies, emphasizes how buildings and surrounding landscapes positively influence health, well-being, performance, emotional functioning, and sense of place.

The most **biophilic** buildings are likely to incorporate multiple features that are revealed in the building façade, lobby, interior design, and surrounding landscape. For instance, the marble used in the façade of the Beinecke Rare Book and Manuscript Library at Yale University is both a natural building element and a feature that provides sensory variability and novelty due to its translucency. As the sunlight changes outdoors, the lighting patterns vary dramatically inside the building. Figure (12)



Figure (12) – The marble used in the façade of the library has a translucency to it that alters daylight entering the interior, lighting patterns vary as the sunlight changes outdoors.

<https://literaryinfrastructures.wordpress.com/>

Another example of a cross –category design feature is illustrated in the Stata Center at the Massachusetts Institute of Technology, designed by Frank Gehry .

The building has Gehry’s signature organic shapes and forms, but the unique **biophilic** feature is the way in which the forms and materials reflect varying patterns of light as the sun shifts in the sky. Figure (13)

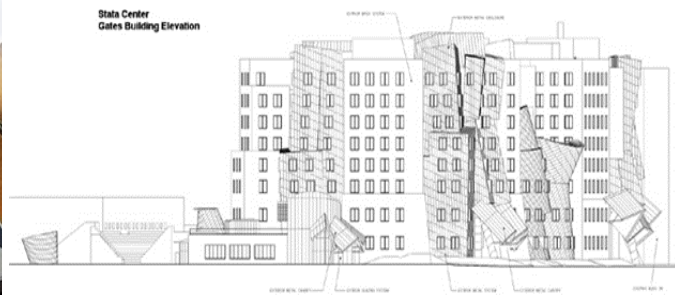


Figure (13) - the Stata Center at the Massachusetts Institute of Technology, designed by Frank Gehry .

<http://4tica.blogspot.com/2015/08/ray-and-maria-stata-center.html>

A third example focuses on the building interior and how light, nature elements, and spatial attributes are integrated. The Seattle Public Library, designed by Rem Koolhaas, has a large public space with a sloped, canopy-like ceiling, distant views, nature elements, and carpeting with a naturalistic pattern. Furnishings and architectural elements featured in the living-room-like space on the main entrance level of the Seattle Public Library take many of their cues from nature – based elements. Interestingly; all three building examples use natural light in unique ways to create a sense of surprise and delight. Further, each design also shows that the essence of **biophilia** can be captured through symbolic representation. Figure (14)



Figure (14) - The Seattle Public Library, designed by Rem Koolhaas .

https://commons.wikimedia.org/wiki/File:Seattle_Public_Library_Main_Branch_Reading_Room.JPG

2-3- a –Biophilic Design Components (table 1):

Component	Examples
Natural Elements	Trees, flowers, grasses, water, rocks, daylight, natural ventilation, natural building materials (wood – stone), naturalistic ornamentation (flowers or animals) and patterns used for surface treatment.
Natural attributes	Sensory variability in sounds, light, color, temperature, and air movement, patterned complexity, growing and development of features over time, organic forms, color splashes, some degree of spatial and element novelty, information richness that encourages exploration and discovery, shiny or glimmering surfaces that symbolize water, changing color or intensity of light to mimic Sunlight.
Spatial relationships	Distant views and view corridors, sense of enclosure and sensory retreat using overhead canopies and vertical screening, irregular clustering of elements, curvilinear surfaces that gradually open information to view.

2-3- b – Benefits of the Biophilic Experience (Healthy buildings = Healthy people):

Research in a variety of fields provides compelling evidence of benefits from contacts with nature. So that some studies show that (Healthy buildings = Healthy people): diagram (2)

- Living in or near green spaces, especially spaces with large trees, enhances human health and mental well-being relative to locations with reduced green space.
- Contact with nature through window views reduces stress at work and improves recovery from illness in hospital settings.
- Moderate amounts of indoor sun improve mood in work settings and reduce depression in mental health settings.
- Daylight, natural ventilation, and good access to window views improve overall satisfaction and comfort at work and may also influence cognitive effectiveness.

- Urban housing developments with green spaces and large trees are more likely to attract people and build community ties than housing developments lacking outdoor sitting areas with trees.

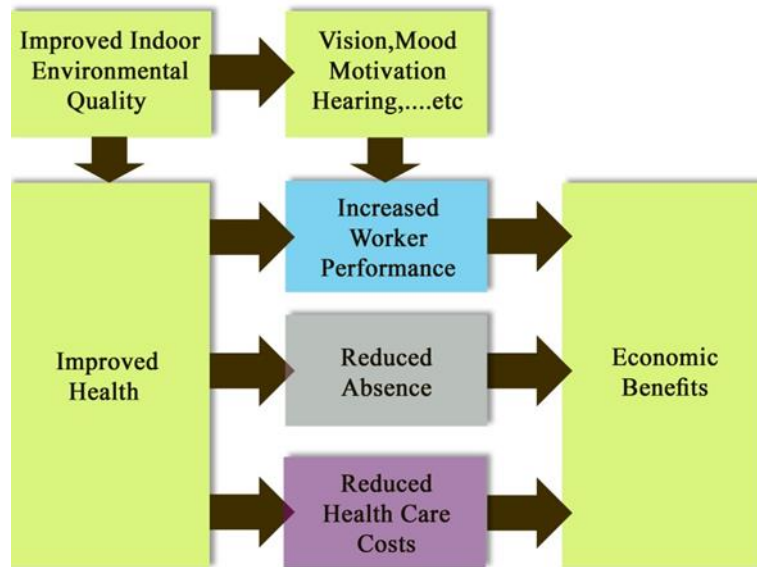


Diagram (2) – Improvements to indoor environmental quality impact positively the health of workers as well as lead to improved vision, mood, and comfort factors. (by the researcher)

- Incorporating sustainable interior design strategies can achieve a number of positive results/reductions / improvements / through a company’s operations and culture. Table (2)

Sustainable Commercial Interiors		
SOCIAL	ECONOMIC	ENVIRONMENT
Perception as a good corporate neighbor	Increased productivity	Reduced emissions
Increased public relations / Marketing opportunities	Reduced capital costs	Reduced ozone depletion
Strengthened relationships with community stakeholders	Reduced operating costs	Waste reduction
Increased customer loyalty satisfaction of doing well by doing good	Reduced liability costs	Efficient materials usage
Aesthetic harmony between building and its natural surrounding	Higher shareholder value	Reduced natural resources consumption
	Higher retail sales	Reduction of toxic substances, and Extend material life cycle

Table (2) – Influence of Sustainable Commercial Interiors on employee health and well-being and improving learning environments.

3 - Putting Sustainability into Practice (Sustainable Commercial Projects):

In this subject, I use exemplar projects to show how the ideas discussed so far in the research can be brought together successfully. The projects demonstrate how a sustainable approach to energy, water, materials and construction can become an integral part of a good design approach, without compromising on other design concerns, including aesthetics. The projects are drawn from around the world and feature a variety of designers –interior designers, furniture designers, architects or artists – to source the best examples across a range of contexts.

3-a- YESHOP Paper cut:

'Papercut' is located on the first floor of a two-storey building at the centre of Athens, where the fashion designer exhibits his work. The need to synthesize the two different approaches to design (fashion design, architecture) was the focal point of this project. Concepts and practices used in fashion design (patron) were incorporated as organizational principles during the design and the construction phases of the project. Figure (15)



Figure (15) – Existing furniture is screwed to the walls to free up the shop floor. Tables are re-used as light shades and bookcases form display shelving. Corrugated cardboard - Corrugated cardboard sheets are glued together in layers over the existing walls to give a three-dimensional effect.

<https://nazmiyalantiquerugs.com/blog/eco-friendly-modern-interior-design-waterstudio-sea-tree-architecture/>

3-b- Glasshouses:

Glasshouses double as informal meeting spots inside the former warehouse in Amsterdam, which has been converted into offices for a pushchair company by Dutch studio Space encounters. Local Architecture and Design Studio Space Encounters removed all the internal walls at the ground level. They split the space into two corridor-like offices separated by tall, plant-filled glasshouses, which reach the whole way up to the roof, where they connect with skylights. Figure (16). Benches nestled among the foliage mean the greenhouses can double as meeting rooms. "The main intervention is three lavish gardens filled with trees, plants, birds and fish," said the studio.

"Extruded from three of the existing roof lights, they echo the scale and logic of what was already there." "Providing a pleasant backdrop for the daily routines, these large glazed gardens also improve the internal climate and provide employees with some more exotic choices to pick as their work location for the day.

"A double-height space containing seating is set on one side of the greenhouses. In the center of this area is a white block work box housing toilets and a cafe with a marbled countertop. The levels are connected by a curving staircase and dotted with leafy pot plants. The studio added a large row of large windows to the building's brick facade.

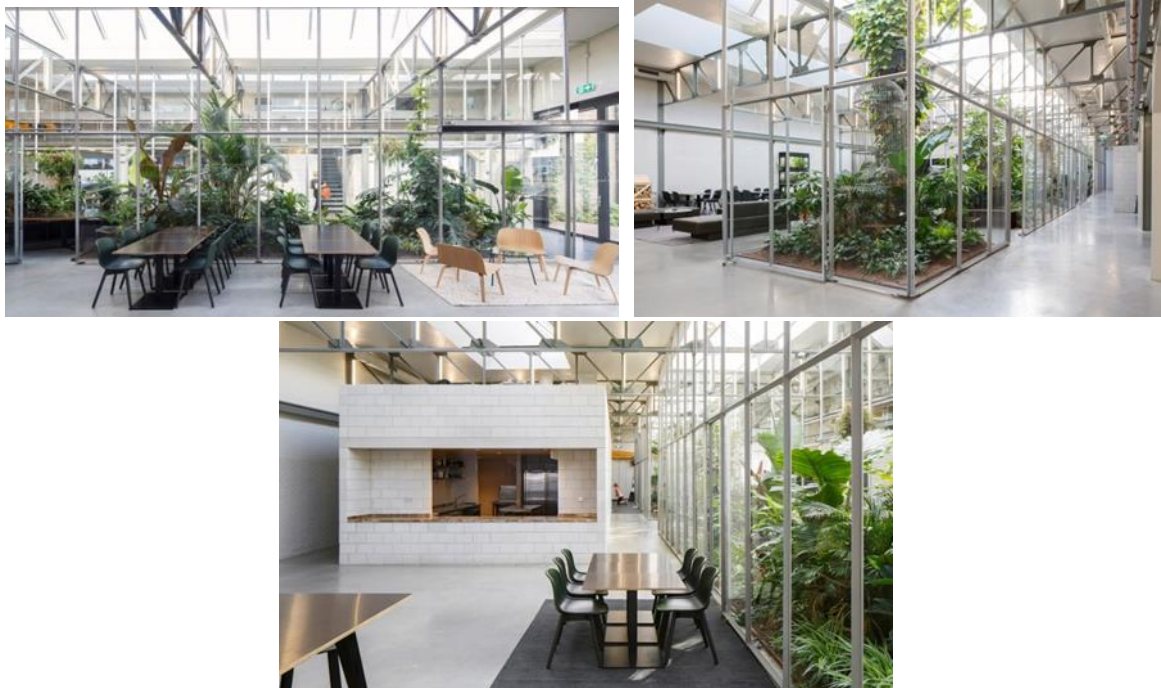


Figure (16) - plant-filled glasshouses, which reach the whole way up to the roof, where they connect with skylights. Benches nestled among the foliage mean the greenhouses, can double as meeting rooms. <https://www.yellowtrace.com.au/space-encounters-joolz-hq-amsterdam/>

3- c- Office building with green hyper core:

Office building with green hyper core presents a concept for a sustainable complex with a large central courtyard. The open ground floor is integrated into the adjacent landscape, and passive design elements allow for continuous natural ventilation throughout the building. Figure (17)



Figure (17) - The open ground floor is integrated into the adjacent landscape, and passive design elements allow for continuous natural ventilation throughout the building. <https://decoratorist.com/modern-milan-apartment-green-design/>

3-d- JW associates plants bamboo office interior in shanghai:

The initial concept of this design was to create an office environment accommodating diverse emotional and working states from the calm and solitary to excited group exchanges. The first stage was the abandonment of excessive ornamentation in favor of function and practicality with a simple color palette of white, grey, and warm, natural wood. Figure (18)

The result is a series of spaces that flow together, connected by their materiality, which provide the necessary variety of environments for the workplace. the design's primary feature is a meandering central island, figure (19) which runs the length of the office's central space in a

series of waves. Functionally, it provides desk space and varied seating, and divides the room. its continuous curve divides the space without creating discreet segments. In addition, the incorporation of stands of bamboo creates a soft and natural separation between the room's two halves. a connecting corridor runs the full length of the space. The organizing circulation joins closed offices at the far end via the central working area, which leads to a kitchen and snack bar that adjoin the reception area immediately before the main entrance. A separate conference room further divides the kitchen area from the main working area. Double doors at the end can be used to isolate each zone as required.

The reception desk, figure (20) utilizes off-cuts leftover as waste material from the construction of the remainder of the project. In contrast, a counter running the length of the kitchen area is coated with TK PET resin that runs down its side to form a continuous surface with the floor of the reception and kitchen area. The clear substance is marked with large brush strokes of Chinese ink, and flows over the floor's boundaries into the central office area and meeting room giving the impression of standing water.

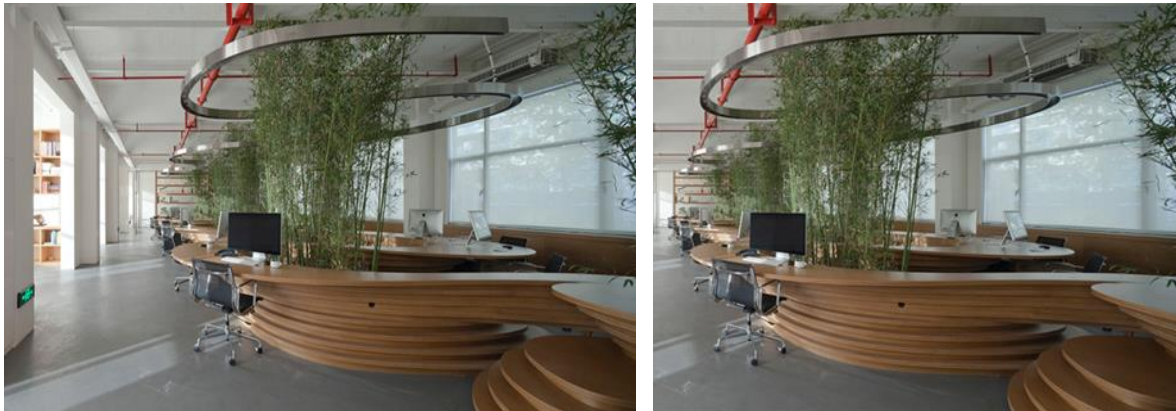


Figure (18) - A single desk runs the length of the main office space in a series of curving loops.

<https://www.designboom.com/architecture/bamboo-office-interior-jw-associates-shanghai-05-19-2014/>



Figure (19) - In working areas daylight balanced lighting is used with warmer lighting used elsewhere

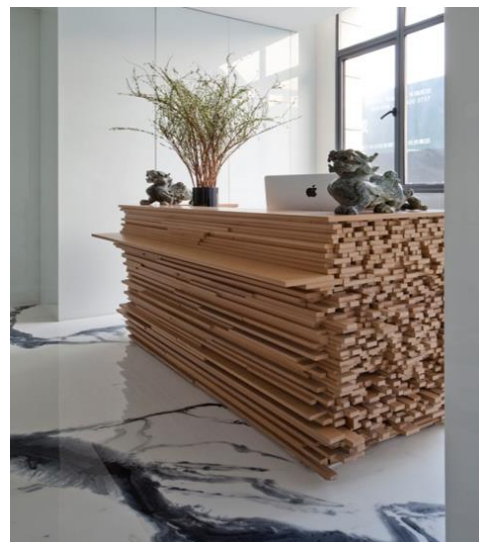


Figure (20) - The reception desk is constructed using waste material from the remainder of the project. <https://www.designboom.com/architecture/bamboo-office-interior-jw-associates-shanghai-05-19-2014/>

3-e- Herzog and de Meuron – Actelion Business Center:

The Center's designers, Herzog & de Meuron melded functionality and aesthetics with a multi-cantilever design that provides space for green roofs and unique angles to allow in maximum natural lighting for each office section.

The Center provides 350 offices for Anthelion employees and encourages a transparent workspace both inside and out. Ducts and piping and installations are all set in the floors and ceilings to open up the interior for glass walls and entryways while large open window facades open the Center to the surrounding environment.

Herzog & de Meuron put reactive louvers on all of the triple glazed windows to adjust with the sun's position. They angled windows so those on the lower floors incline upwards and those on the upper floors downward to better capture and utilize solar heat and incorporated photovoltaic cells for electricity. Figure (21) each of the six floors has a unique footprint and many hang seemingly impossible lengths over the floors below them. These unique floor plans create open spaces for green roofs on the third and fifth floors to encourage comfort and provide green space for stifled employees. Vertical access is provided in the four corner points where floors meet. Surrounding these points are meeting rooms and lounging areas to further encourage communication between employees and departments.



Figure (21) - each of the six floors has a unique footprint and many hang seemingly impossible lengths over the floors below them. These unique floor plans create open spaces for green roofs on the third and fifth floors to encourage comfort and provide green space for stifled employees.

<https://www.archilovers.com/projects/34820/the-actelion-business-center.html>

3-f- The Pallet Project by MOST Architecture:

The idea to use Euro-pallets for this design is to be a recyclable material. The pallet structure; an open, autonomous landscape that gradually changes its character, facilitates all parts of the office. The pallet structure is designed in such a way that besides being merely a workplace, the entire element invites the client to stand, sit or lay down on the pallets. This open office concept was created to suit the creative advertising agency, with an additional, informal atmosphere.

The design concept, an open autonomous landscape, consists of 3 layers. The first layer, the existing space was used as a starting position and painted completely white, to provide a homogeneous base for the pallet structure. The pallets itself create a structure that slowly changes its character accommodating all parts of the office. Finally, the third layer in the design contains additions to the pallet structure like light fixtures, staircase banisters and the furniture; which are all done in black. The structure is not dictating, rather facilitating.

The pallet structure unites the whole space, covering the whole depth of the building in one single movement. The design can loosely be divided into four zones: The entrance area, the staircase area, the split level area and the studio area, in the back of the ground floor. Entrance area: coming in, the pallet structure welcomes its visitors with open arms, created by two rows of desks, providing a total of eight working units on two different levels. Visitors walk onto the pallet structure like a catwalk, surrounded by Brand Base employees. Figure (22) Staircase area: the working units in the entrance area make way for a staircase that is divided in two parts; the formal part with its steps and banisters and a more informal part, where stacked pallets provide a place to hang-out.

Split level area: reaching the upper floor, the staircase transforms into the management premises, with a combined presentation- and meeting room. Here, the four desks are designed more independently. Subsequently the pallet structure, separated by a transparent wall with translucent doors, develops into the presentation room with its seating element that accommodates guests during presentations. In front of this, a huge movable boardroom table made of pallets.

The studio area: the rear part of the ground floor was dealt with in a totally different way. The efficient positions of the white desks are connected with the pallet structure through black wires, which hang along the ceiling from the staircase to the desks and servers like lianas.



Figure (22) - The pallet structure unites the whole space, covering the whole depth of the building in one single movement. The design can loosely be divided into four zones: The entrance area, the staircase area, the split level area and the studio area, in the back of the ground floor.

<https://www.ar2embalagens.com.br/outros-produtos?lightbox=dataItem-iem844gg>

3-g- Sustainable Interior Design Initiative for Smart Dubai:

The concept of sustainability, the approach started with material selection – everything is used was recycled, even the way in which lighting control and chimers to make sure the lights were only used when needed in the night-time, so it’s all really about energy saving.” Smart Dubai spends each day coming up with initiatives to make Dubai the happiest city on earth. The designer Nadine Abedzadeh wanted to give them the happiest workplace from which they can do it. Figure (23)



Figure (23) - everything is used was recycled. Wooden panels, forming ceilings, seats and suspended chairs. https://www.lovetthatdesign.com/project/smart-dubai-office-dubai/?utm_campaign=58fda17cd4dbac2b2d05169a&utm_content=59954b8b3622f13a7d00a5ea&utm_medium=smarpshare&utm_source=twitter

3-h- Rooftop Boardroom with Panoramic Indoor Garden (CCIS building):

The designer formed an inner interior winter garden (by transforming completely the large summer banquet terrace and current VIP boardroom into a lush indoor garden space with dramatic swooping garden beds and plants throughout), where a spatial ribbon carries the troughs and baskets with lush tropical greenery, where the employees and clients can enjoy a magnificent view of the city center.

Besides the vertical executive business and club rooms, it also represents the most attractive interior space. It may be characterized as a new type of the business and club room that is intended for events such as ceremonial receptions, award-granting ceremonies, and banquet luncheons as well as for meetings of the extended management team.

The green ribbon also enables the partition of the space into several micro-ambiences that may be used according to the type of event and the number of participants. The plants and greenery in the interior, the play of light and shadow, enabled by the shade-like structures, and the views to the outer spaces at the top of CCIS building jointly create a relaxed working atmosphere.

Figure (24)

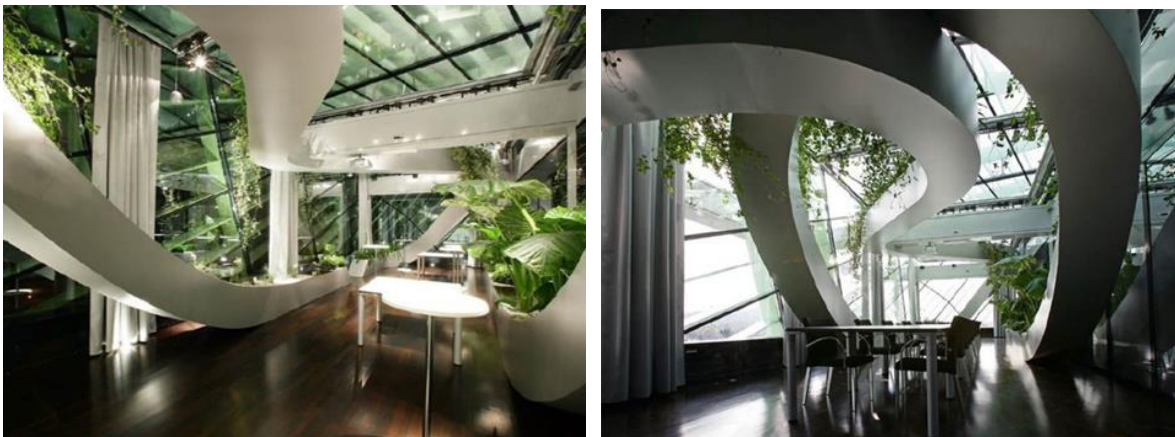


Figure (24) - CCIS building- The green ribbon also enables the partition of the space into several micro-ambiences that may be used according to the type of event and the number of participants. <https://mesflaneries.wordpress.com/2012/06/10/un-jardin-au-bureau/>

3-i- Office in the Woods:

Spanish architects Jose Selgas and Lucia Cano of SelgasCano have designed an office for their own practice, located in the woods near Madrid in Spain.

A 20mm thick, curved window made of transparent acrylic forms the north-facing wall of the tunnel-like space. The opaque, south-facing aspect is constructed from a 110mm thick, insulated, fiber-glass and polyester sandwich, offering shade from direct sunlight.

A hinged opening attached to a weighted pulley mechanism at one end of the building allows varying degrees of natural ventilation. Figure (25)

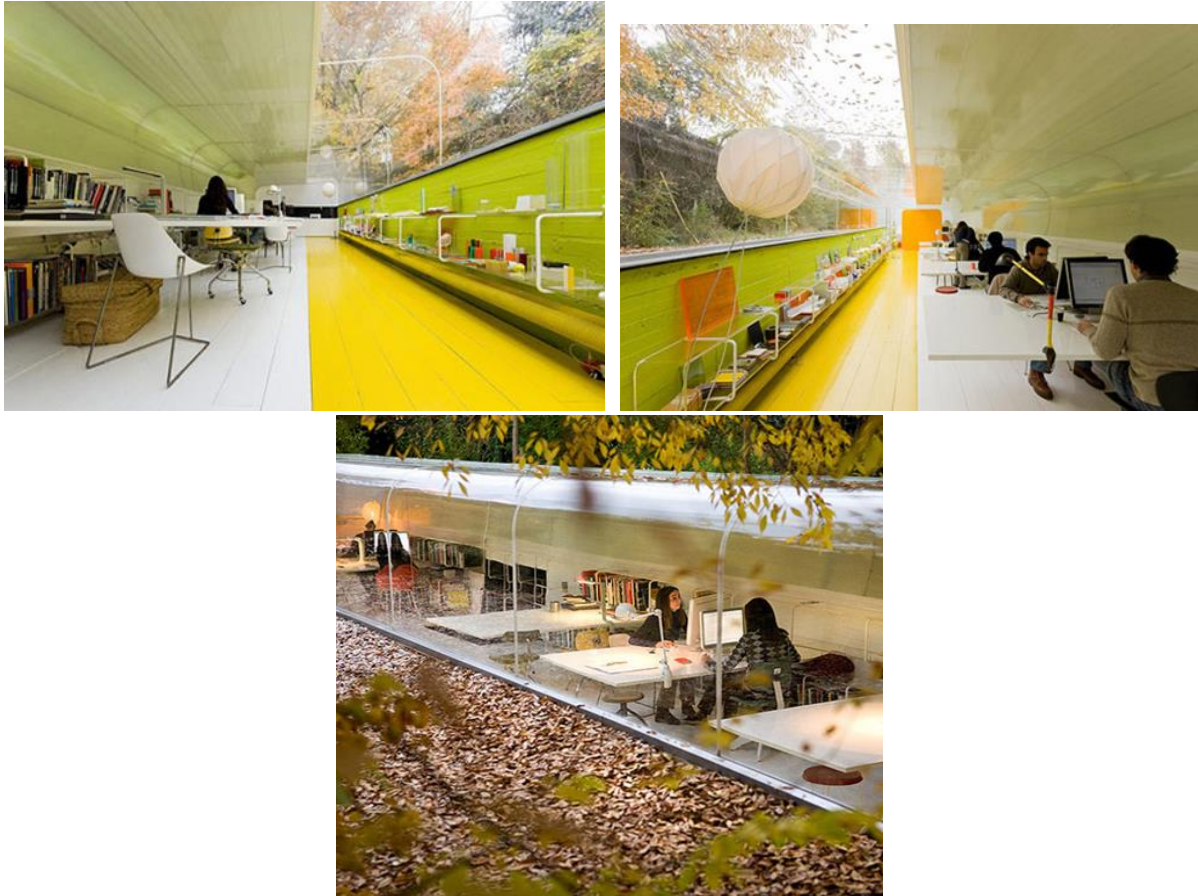


Figure (25) - Office in the Woods - curved window made of transparent acrylic forms the north-facing wall of the tunnel-like space. The opaque, south-facing aspect is constructed from a 110mm thick, insulated, fiber-glass and polyester sandwich, offering shade from direct sunlight.

https://thearchitect.pro/ru/news/5977-Ofisy_dizaynerskyh_byuro_kotorie_ty_doljen_videt

Research Results:

- There are three major branches of research in the field of healthy buildings: Materials and ventilation – Day lighting - Access to nature - A company that ignores the needs of the workers, could end up with a beautiful building but a miserable environment to work in.
- As part of the sustainable office design process and the cost savings, it's advisable to consider which materials can be repurposed, recycled and re-used elsewhere within the office.
- A sustainable office should provide more natural light, better air quality, optimum temperatures, and improved acoustics, which in turn means a happier and healthier workforce, leading to improved employee productivity.

- Creating an environmentally friendly and sustainable office shouldn't stop with the physical building or office interior. It should run through the core of the organization and culture of the business.

Research Recommendations:

- The importance of integrating the role of interior architecture designer with research on sustainability and recycling and modern technologies for environmentally friendly materials.
- Develop strategic plans for waste recycling and reuse of resources, as well as organize workshops and seminars on the development of environment eco materials technologies.
- Interest in studying new environmental materials that help in the process of technical innovation and solutions for interior architecture.
- The need to delve deeper into the study of sustainable architecture techniques must go hand in hand with the extent to which these technologies can be used in contemporary local economic terms.

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