

# The Biophilic Design Guide

Text by Sally Augustin PhD

Edited & Illustrated by Vanessa Champion PhD

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# MillerKnoll



A handy  
pocket sized  
guide to  
biophilic  
design

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The earliest humans had it tough. What with all of their scraping by, foraging for fruits and vegetables, killing the occasional mammoth for lunch, and not becoming the next meal of any lion or tiger or bear that happened to be wandering by.

The places where our ancestors could be comfortable for those challenging primordial aeons were very particular sorts of spots and, via an astounding collection of sensory memories, we continue to find the same types of areas very comfortable spaces to spend time today.

So comfortable, in fact, that even now our brains as well as our bodies feel good and work well when we're in built spaces that share the core design elements of those long, long ago locations. Our stress levels fall, which helps our bodies feel good. As our moods get better and our comfort levels rise, we do a great job with analytical reasoning, creativity, and getting along with others, just for starters. We feel that we can achieve what we've set out to do, we have some power over the world that surrounds us, and we can mingle with others when we choose. Our minds can be refreshed by experiences we have in biophilic areas.

How can we generate biophilically designed spaces, ones that will do so many good things for our minds and our bodies?

“Biophilic design” sounds like it should be all about plants and gardening, and it is in part—but there’s a lot more to it than vegetation.

In the paragraphs to come, we’ll get into the nitty gritty, the literal how to of indoor biophilic design—there’ll be no extended passages about beauty and conserving the environment here—although how could we possibly be anti-beauty or against saving the planet?

If you’re an outdoor space designer/manager/ doer type: Brains are brains, people are people, no matter where they are. The information we’ll cover is completely applicable in your work as well—with obvious modifications—for example, you’ll need to think about curving outdoor paths instead of indoor ones and you’ll be adding scents via actual, living plants and not HVAC systems.

If you live in the bits and bytes world, you’ll be pleased to know that virtual reality biophilic design, when done with truly realistic visuals, etc., can have the same positive effects as biophilic design in real life.



## The Room Itself

Let's start with the basics of the room into which we intend to pack all the biophilic design goodness.

A biophilic zone needs to seem appropriately spacious and places that are spacious:

- Have light-coloured walls and a ceiling that's the lightest colour or all
- Are more brightly lit and that light is evenly distributed throughout the space
- May have mirrored walls
- Are pleasantly scented
- Have lots of windows, to outside and other interior spaces
- Have ceilings at least 10 feet tall, if possible
- Have elongated floorplans, like skinny-ish rectangles, not squares (shape has a big effect on perceived size)
- Support the activity-at-hand, whether that's dining, doing mental work that requires concentration, or something else entirely

A ceiling height of about 10 to 11 feet generally works well in a biophilic room, but higher is possible in commercial spaces and very warm parts of the world. Too high and situations seem formal. But when things do seem formal, we tend to be better behaved, which keeps down indiscretions in places like the cavernous main hall at Grand Central Station in New York City. If you want people to mingle in a relaxed way, don't raise the ceiling much above 11 feet as that results in the stilted, peculiar-feeling exchanges that are so common in McMansion Great Rooms.

Your biophilic room needs windows to outdoors, with mullions is best. Ideally those windows frame views of nature. If no nature views are possible, we do have a fix (read on).

The windows need to let in as much natural light – without glare – as is reasonable based on climate (very, very large windows can influence heating and cooling an area), and what will likely happen in a space. We prefer smaller windows to outdoors in more private spaces such as bathrooms and bedrooms, for example.

Glass panels—on walls and doors—high and low—that allow natural light to flow through an area are a big plus biophilically.

To cut glare and views in and out curtains of various weights work well. Windows that change colour to block glare can distort the appearance of sunlight flowing in and views seen outdoors in ways that reduce their value.



Some internal sight lines should provide expansive views through the space and ideally at least a few peaks to outside. This doesn't mean open plan is decreed—extraverts and introverts favour different amounts of openness. Having expansive in-space views does mean that doorways and other internal openings are thoughtfully placed, however.



We don't like the sensation of people walking behind us (anywhere) or more than just a few sitting in back of us (in a workplace). Also, to see seas of colleagues spread out before us in workplaces can have negative effects on our mindsets at work. Zones of various sorts can be sized accordingly, breaking areas up to no more than just over a dozen or so people can be seen.

Gently curving hallways between rooms are best, they lead us forward, deeper into a space.

## Lighting

For creativity and socialising pleasantly with others, warmer slightly dimmer light is best while for concentration and being active brighter cooler options are better choices.

To be their most powerful, warm light bulbs should be placed in tabletop and floor lamps and cool lights overhead.

Ideally, only warm or only cool lights are turned on in a space at any one time, so have multiple colour options in place in multi-use areas.

Lightbulb packages are labelled warm or cool. Cool ones are around 5000 Kelvin or more while warmer ones are closer to 2700 to 3000 Kelvin.

Circadian lighting is desirable, particularly in a place with limited or no daylight and/or where people will be for extended periods and overnight. Special bulbs and fixtures support circadian lighting.

The core principles of circadian lighting include brighter light during the more active part of the day, for example around midday, and dimmer lighting at waking and at night—just as the intensity of light from the sun is different around noon and at dawn and dusk. Circadian lighting is also cooler around midday and warmer at the start and the end of our days, again, just like the light from our Sun.





## Colours

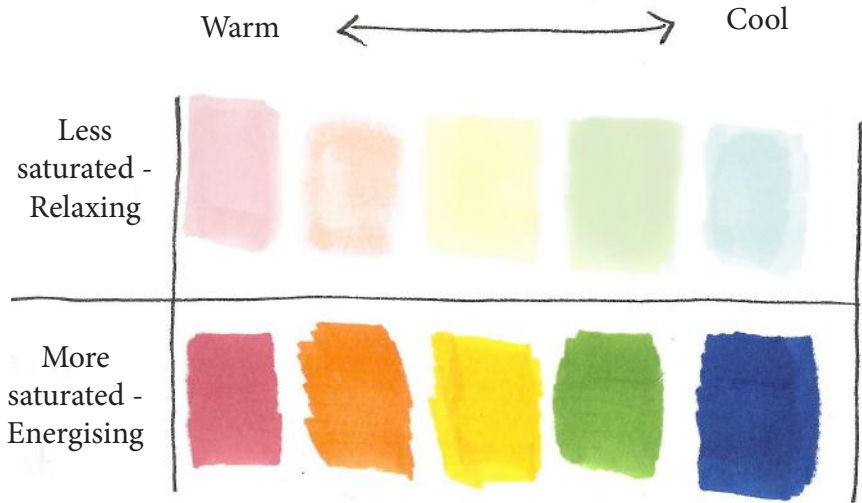
Wherever they are—on walls, upholstery, etc., colours that are less saturated and relatively light are relaxing to view while ones that are more saturated and darker are more energizing to see. So, sage greens with lots of white mixed into them are great for break rooms and emerald green accents in copy machine rooms can be very handy.

We are most comfortable in a space when the darkest colour in it is on the floor, the lightest is on the ceiling, and the walls are intermediate shades.

Compared to warm colours when we are looking at cooler colours we feel:

- Physically cooler (the effect can be 5 degrees Fahrenheit)—which can be handy when you're trying to create an entryway into a building in a warm weather zone near the Equator.
- More empowered
- That we've spent less time waiting
- Less positive about the people nearby—when warm colours predominate we think the humans around us are friendlier.
- A little less hungry (maybe)

Colours such as oranges and reds and yellows are warm and blues and greens are cool.



Seeing the colour red, even briefly, degrades our analytical performance but seeing greens has been linked to greater creativity. So, in offices, reds are a liability and greens an asset.

## Patterns

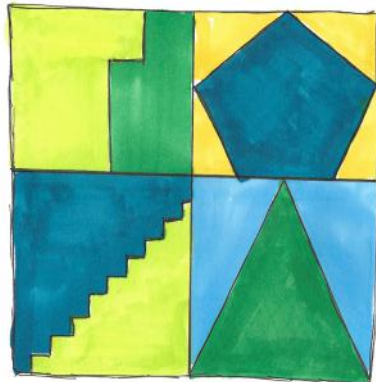
In 2- and 3-dimensions, we find it comforting and relaxing to look at curving lines while straight ones bring thoughts of efficiency and action to mind.

Patterns that incorporate relatively more curving lines than straight ones are calming to view while the reverse is true of more rectilinear ones.



Upholster the chairs in the breakroom with a more organic looking pattern, for example.

The floor in the long hallway that people should walk to the end of as quickly as they can is a good location for a geometric print carpet—squares, rectangles, hexagons, triangles, etc., galore.



Symmetry does have a special place in our hearts—we generally prefer symmetry (in all its versions) to asymmetry with symmetry conjuring up associations to calmness, stability, order, harmony, and sophistication and asymmetry to energy and excitement.

Patterns almost always involve multiple colours and colours with similar saturation levels make more harmonious, pleasant combinations. The same goes for sets with more similar hues. Small differences in lightness can degrade the viewing experience.

The benefits of seeing moderate-complexity nature-resonant fractals include reduced stress and enhanced mood, cognitive performance, and concentration. For more information, take a look at Terrapin Bright Green’s free online resource for incorporating fractals into space, “Working with Fractals,” available here: <https://www.terrapinbrightgreen.com/report/biophilia-fractals-toolkit/>



## Visual Clutter

Visual clutter stresses us, which degrades our ability to do whatever we've planned. Clutter comes from the number of colours, shapes, and patterns we can see and the apparent order with which they're arranged.

The goal is moderate visual clutter or complexity which is the amount found in a residential space designed by Frank Lloyd Wright—compare a space you're considering to one of FLW's home interiors to see how it does.



Just about the correct amount of visual complexity



Too much visual complexity



Not enough visual complexity

## Yes, Plants

When people can see green leafy plants indoors, in pots or planters, all sorts of good things happen in their heads, from enhanced cognitive performance and creativity to lower stress levels. Spike-y plants just don't fit the bill here and do all for you that leafy, curvy ones do (but at least they are green, see the section on colour).

The goal needs to be that people see one or two green leafy plants that are a few feet tall any time they look across an area. More plants seem like a great idea, but they aren't. They increase visual complexity and can drive it to stress inducing levels.



Our minds treat the plants in green walls as if they were a single organism, impact-wise, so multiple plants in green walls work fine—but the biggest possible green wall is not necessarily the best one. Research has shown superior effects for petit green walls, one or two meters by one or two meters – having green walls a few meters square in view can have had powerful, beneficial consequences neuroscientifically.

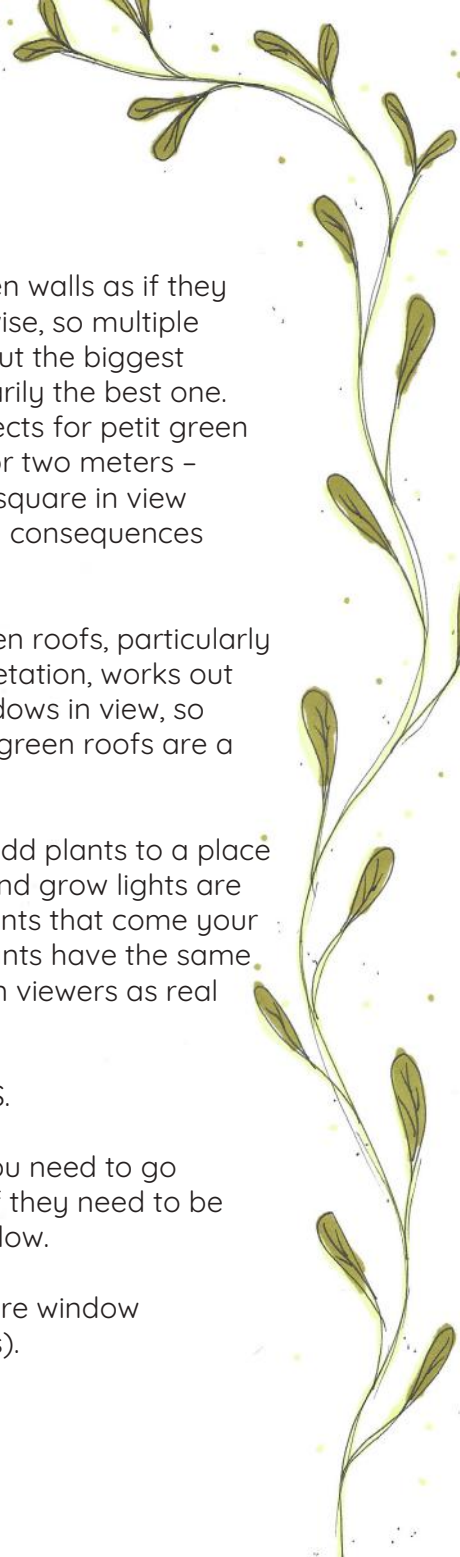
Looking out of windows onto green roofs, particularly ones planted with prairie like vegetation, works out as well as having expansive meadows in view, so community efforts to encourage green roofs are a good use of time.

All is not lost if you are trying to add plants to a place where the light is murky at best and grow lights are not an option, if you kill all the plants that come your way, etc. Artificial green leafy plants have the same desirable psychological effects on viewers as real ones,

**BUT THEY MUST BE GOOD FAKES.**

They need to be so lifelike that you need to go over and touch them to find out if they need to be watered for “plant goodness” to flow.

You can also create a virtual nature window (more information on that follows).



## Water... and Mirrors and Fire

When we can see gently moving water, our brains refresh, and its effects are particularly strong when we can hear it as well.

A human-made fountain a couple of feet tall in a courtyard or a desktop fountain can both be effective at helping with mental exhaustion and stress, especially if they generate a burbling sound (more on nature sounds coming up!).

Fish tanks (even if they don't have any fish in them!) have the same effect on what goes on in our heads—so too does looking at fire, but incorporating fire into spaces inside buildings can be a daunting endeavour, regulation- and other-wise—but think how comfortable our primordial selves must have been around a campfire, particularly if we'd just eaten dinner.

Humans prefer mirrored surfaces to matte ones (but too many mirrored ones can sometimes lead to stress-inducing glare). When we see ourselves in a mirror, we are more apt to behave in socially desired ways than when we don't—so a reflective wall treatment near recycling containers can encourage people to sort their recycling as the recycling gods intended.



## Art and Awe

Art (in 2- and 3-dimensions, moving and still) depicting nature can mentally refresh (more on this in a few paragraphs).

Art that doesn't somehow show nature, say abstract images, will influence mindsets based on the sets of colours used in it and its ratio of curved to straight lines as well as any nonverbal messages it sends to viewers about corporate goals, etc.

No room for art because wall space is low (you've put in lots of windows, for example)? Think screensavers and curate them for maximum psychological benefit.

Through technique, workmanship, materials, size, etc., art (and design in general) can generate awe and when we feel awed, we behave more positively toward other people. we think more creatively. excel



## Cognitive Refreshment

Our brains are refreshed by looking at art (still and moving, paintings and photographic) depicting temperate climate nature scenes (preferably a meadow on a lovely Spring day but other seasons can work also), a couple of green leafy plants indoors, and wood with visible grain. The same goes for seeing even small, say desktop, water features.

Looking outside at nature (particularly with a gently moving water feature) also mentally refreshes.

The most revitalizing sorts of nature scenes to view in art or windows, look like we could easily step into them, as Mary Poppins steps into Bert's chalk drawings in the Mary Poppins movie—there isn't a wall or a fence or something similar blocking our way in. They are also places where it seems that we could take cover if danger something dangerous arrives (for example, there's a tree we could climb to escape).

The best sort of views outside, for mental refreshment, stress-reducing, show native-to-the-location plants and gently moving water. If a building is in a desert the best sorts of landscapes to view would feature the sorts of nature that might be present in nearby higher elevations that support more green leafy plants year-round or during the rainy season—looking at bleak nature scenes can have negative effects.

When all else fails, is too difficult, etc., go with virtual window views of nature, prints, AV, photos and art work.

## Natural Materials

Being around natural materials makes us comfortable and we need them in biophilic areas.

Seeing wood with visible grain is good for our stress levels and our cognitive performance, particularly when it has a warm finish.

Not every surface should be covered with wood—no more than about half work best (include wood on furniture but don't include doors and windows when you're calculating coverage percentages).

Materials that develop a patina over time or gracefully show wear, such as copper and leather, are particularly well received by human minds.

Natural fabrics, say linen or silk (silk if your space users are among the better-behaved), can also be biophilic stars.

And if the strength of the structure can support it, literally, stone is a great biophilic material.

## Gentle Movement

Something in an area, a curtain in a window draft, a mobile in an HVAC current, for instance, needs to move gently in a biophilic space—even the most serene outdoor spaces are not inert.





## Furniture

In a biophilic room, at least some seats need to provide what's known as prospect and refuge. That means people sitting or standing in them feel safe, because they feel protected (by a tall seat back, or wall, or plant, etc.), and the in-space humans can see into the distance, the world around them. With prospect and refuge, we feel a lot like we would have felt looking out over our world from a perch high in a tree. Clearly, not all furniture in a space can be placed for prospect and refuge, that would distort the personal spaces between people talking, for instance, but at least some in any area needs to be.

The most comfortable of all the comfortable people in a room will have a view to the entrance of the area they're in, whether they're trying to sleep or work.

Furniture options provided need to make it probable that everyone who is likely to be engaged in a conversation will be in a seat whose legs are the same length. When chair leg lengths are different, or some people in a conversation are sitting on the floor while others are in chairs, etc., certain people are being looked up at during discussions and others are being looked down on, which distorts the apparent value of what those being looked up to or down on are saying in predictable ways.

## Feeling

Humans like being in spaces with fresh-seeming air, ideally gently flowing in through windows they can open, that is around 70 to 72 degrees Fahrenheit, with relative humidity of 40 to 70 per cent.

Soft materials, like flannels, are comforting to feel, and cold metals can be jarring to encounter.

Humans feel more sociable when they're touching warm things and some materials warm more quickly and retain heat longer than others.

## Hearing

White noise can be useful for sound masking but, for optimizing mood and performance in biophilic spaces, very quietly playing (barely audible) nature soundscapes of burbling brooks, faintly rustling leaves and grasses, and peacefully singing songbirds are best.

A space that seems too quiet to us is as distressing as one that seems over-loud, the natural world only seems to be silent when danger is imminent.



## Smelling

Scents in a space should be very subtle. Make sure that no more than 50% of those present can even identify a scent added when asked about smells directly and that only a few percent of space users spontaneously mention that a scent has been introduced to an area when they're queried about their impressions of a place.

Natural scents that can be useful, regardless of culture and whether people are even aware they are smelling them, include:

- Lavender – for relaxation and increasing trust among people present in a space
- Orange – to reduce anxiety. The same effect is found for floral smells and the scent of vanilla.
- Lemon – for relaxation and elevated cognitive performance
- Mango – for relaxing
- Rosemary and garden sage – to enhance memory function
- Peppermint – to enhance memory function, improve performance on more tedious monotonous work
- Rosemary, peppermint, grapefruit, eucalyptus (for example) – for feeling more alert and energized
- 

Our mood improves in places we think smell good, and we like to spend time in them.



## Environmental Control

From very, very early on in our time as a species, we've relished the opportunity to have some control over our physical world, a curated set of choices significantly increases how comfortable we feel.

For our best mental health and performance, we shouldn't be overwhelmed by options, a set of 4 to 6 that are reasonable alternatives, based on what we're up to, is best. That means 4 to 6 preset lighting options, combining light colour and intensity, in a conference room (one for group meetings, one for birthday parties, etc.) suits us better than dials that can be turned through every potential light colour and intensity level.

## Consistency

Simultaneous sensory experiences need to work together harmoniously to generate consistent effects in people's heads. Calming scents with calming sounds, for example, are best—consistent associations in people's minds are also key, typical summer scents with typical summer soundtracks, for instance).

When all doesn't align, efforts to guide experiences in positive ways via design can backfire. Confusion sets in and with confusion comes stress.

## And Biophilic Design can be Good for our World . . .

Biophilic design improves human mental and physical wellbeing, elevating our cognitive performance, for instance—and it's also good for our planet.

Researchers have seen links between biophilic design and increased concern about the Earth's health, with planet-sustaining effects on actions taken—which is very, very important indeed as human activities otherwise seem to be making the air we breathe, the ground we walk on, and the water we drink and swim in less and less wholesome for humans.

## Conclusion

Neuroscience research makes it clear that biophilic design has positive repercussions for our brains and bodies wherever we are. It elevates in-workplace mental performance (and bottom line results for organizations), sales in stores, healing speeds in hospitals, rejuvenation rates at hotels—you name it, biophilic design improves it, regardless of our age, nationality, gender, etc.



## Who we are

Sally Augustin, PhD, has extensive experience integrating insights from neuroscience, social/physical sciences, and project-specific research to inform the design of places, objects, and services that support desired cognitive, emotional, and physical outcomes/experiences. She is a Principal at Design With Science, a Co-Founder of The Space Doctors, and the Editor of Research Design Connections, as well as the author of Designology, Place Advantage: Applied Psychology for Interior Architecture, and The Designer's Guide to Doing Research: Applying Knowledge to Inform Design (Cindy Coleman, co-author). Dr. Augustin is a Fellow of the American Psychological Association and a 2024 TEDx speaker.

Vanessa Champion, PhD, originally an academic at UCL, has a PhD in Greek and Latin, and also worked in the British Museum, honing her interest in research in how societies flourish and how the visual and physical environment informs our behaviours. After editing a London newspaper she set up her own media company and consultancy working with clients including the BBC, ITV, Banks, manufacturing, NHS, etc. But it was after witnessing first hand the biophilic healing effect a nature view had on recovery in hospital, that she founded The Journal of Biophilic Design to share interviews with thought leaders on how biophilia supports wellbeing for people, planet and place. Passionate about this beautiful planet we live on, Ness is a nature lover, professional photographer, artist and print maker and creates "Virtual Nature Walls" for healthcare, schools, offices and homes. Ness is also founder of the philanthropic media agency PhotoAid Global Foundation and co-founder of The Space Doctors.

# MillerKnoll

Too often, the physical environments where people work, learn, and heal are viewed solely as institutional settings that increase stress levels, rather than as spaces that can promote well-being. As advocates for human-centred spaces, MillerKnoll believes that biophilic design offers a transformative approach to creating interiors that enhance performance, comfort and engagement. This benefits both the users of these spaces and the organisations that invest in them. We are grateful for our ongoing collaboration with Dr. Sally Augustin, whose expertise in environmental psychology and Biophilic Design is recognised worldwide. We are pleased to support the publication of this Guide in the hope of designing spaces that benefit humankind.





## An Ode to Biophilic Design

The space where your brain works for its best all the day  
Gets your wits all on task now in just the right way.  
What you see, what you hear, what you touch with your hand  
Puts your head in the clouds or down deep in the sand.

In lab coats and trench coats and no real coats at all  
Scientists collecting data at office and hall  
Have probed what you see, what you hear, what you touch,  
And how it affects how you think, act, and all such.

They've found rules you can use to live as you choose  
Achieve your goals and your aims and your self amuse.  
Lots of biophilic ones follow this line below  
Use them at home or work or wherever apropos.

Biophilic design reflects our lives on the plains  
When we were a young species with prehistory's pains.  
What's known about early sights, sounds, and smells, and  
yes, feels,  
When now applied makes us happy and boosts our zeal.

Colours are everywhere even spaces black and white  
Use them effectively to harness their great might.  
See green to give your creativity a boost.  
Cut red to keep brain logic from being reduced.

To relax look at shades vaguely greyish and bright  
Like a sage green mix with white, that is fresh and is light.  
Or dusty blue or peach that seems just more than tint  
When you want to calm and counter the day's hard sprint.

Warm colours around make a space seem, well, hotter.  
See cool colours then jumpers and scarves you'll gather.  
When we see warm colours, our appetites do grow  
Don't use them unless you have the waist of a doe.

Cool coloured walls make you feel like big chief in charge  
Warm ones bond friendships, yes just like Homer and Marge.  
Select warm or cool for your spots to spend real time  
If you want friendly or power feelings to climb.

Lines can be straight or curve like a frond in the sun  
Straight conveys "function" and is for "useful" not "fun."  
Use more curves to relax and straight lines to rev up  
Always mix both so you don't overflow either cup.

Look at wood with grain to keep stress levels in check.  
Manage clutter but don't make a space bare, no heck!  
Use as many colours and shapes, placed with a plan  
As Frank Lloyd Wright's home interior design rooms can.

We need to look and a few green leafy plants find  
And a place with warm low light when set to unwind.  
Cooler higher lights lead to greater energy flows.  
Things that age with patina are never no-no's.

Scents only add power when they're truly subtle  
When people can name them all's lost on the double.  
Smell lavender to relax and to trust others.  
Lemon's a brain lift, use that other than druthers.

Noise blasts away focus leaving meh in its place  
And oh so unhappy looks all over our fine face.  
Shielding is good to preserve wanted comprehension  
But silence will also yes push up the tension.

Put on buds, play music loud, seems like a solution.  
White noise is better than pop for noise dilution.  
Best of all are nature soundtracks quietly played  
Rustling leaves, gentle water and birds make the grade.

You really relax and your brain does best thinking  
When you sit secure with your back safe while linking  
Your view to the world round, as from a deli booth,  
Or a high-backed chair, another real science true truth.

To refresh and de-stress our too tired sore head  
To hear nature or see it works like time abed.  
Photos or videos or scenes through a real window  
Restock our brain energy and are not much dough!

To do our best think we need control of our place.  
To select our own seat or the light in the space,  
Makes our mind work much better and our pulse rate drops  
Because we can align our then needs with our props.

The best places all seem somewhat safe and seem known,  
People all grasp how to be and use them as shown.  
They change cross time to keep down user's bore boredom,  
Novel changes are judged slight in postmortems.

Science has probed how our sensory systems drive  
What goes on as we work and try so hard to thrive.  
Neuroscience research is a useful real sexy thing.  
It shows that biophilic design makes our brains sing.

An aide memoire for Biophilic Design  
by the original Space Doctor - Sally Augustin PhD

