AtkinsRéalis

Neuroinclusive Office Design

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Introduction

This publication has been prepared in good faith and is intended to raise awareness, provide guidance and recommendations for neuroinclusion within the physical workplace.

The document does not cover the construction of the building, nor is it intended as a specification or a code of practice. This is a thought piece which explores and explains the topic of Neurodiversity, highlighting the importance and benefit of designing inclusive workplaces for as many people as possible.

Acknowledgements

The following documents are referenced throughout the report and are highly recommended reading for further expansion of knowledge on this subject.

PAS 6463:2022 Design for the mind – Neurodiversity and the built environment – Guide
https://www.bsigroup.com/en-GB/standards/pas-6463/

British Council for Offices (2022). Designing for Neurodiversity
http://www.bco.org.uk/Research/Publications/Designing_for_Neurodiversity.aspx

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What is Neurodiversity?

Neurotypical & Neurodiverse

Neurodiversity refers to the infinite range of differences in individual human brain function and behavioural traits. Rather than defining a subgroup of individuals, the term refers to the countless variations in the way people think. It is not about one condition or difference, rather the term recognizes the variety in the way we speak, think, move, act and communicate.

Typically neurological profiles can be collectively grouped as:

a. neurotypical b. neurodivergent

Many people operate and respond to outside stimuli in a range perceived as neurotypical, with those falling beyond this range considered neurodivergent.

Diversity of Neurodivergence

It is estimated that 1 in 7 people are likely neurodivergent in some way.

Below are a few examples of neurodivergence, however this list is not exhaustive:

- Autism, including Asperger's Syndrome;
- Dyslexia;
- Dyspraxia;
- Dyscalculia;
- Central Auditory Processing Disorder;
- Attention Deficit Hyperactivity Disorder (ADHD);
- Tic Disorders;
- OCD;
- Tourette Syndrome.

Society has tended to treat these alternative thinking styles as disorders – conditions diagnosed most often in childhood, by a deficit model – focusing on what the child struggles with, when compared with their peers.

However it has been proven, both emperically and imperically, that the 'thought difference' arising from neurodivergence can lead to strengths that are highly sought after in the business context, including: cognitive pattern recognition, outside-the-box thinking, attention to detail, logical and methodical thinking, focus and integrity.

It is important to remember that whilst neurodivergence is a strength, many adults also face challenges in working and living in an environment designed for neurotypicals. This can (amongst other challenges) lead to anxiety, stress and/or depression. This is why is it important to ensure a persons neurodiverse needs are catered for in the way the organisation is run, and the physical environment is designed.

NB Digital environments are also important, but are not the subject of this document.

Neurodiversity

Rather then defining a subgroup of individuals, the term refers to the countless variations in the way people think.

Most people respond to outside stimuli in a range perceived as neurotypical, with those falling outside of this range considered neurodivergent.

Why is Neurodiversity important?

Diversity in the way we think, and our range of cognitive abilities leads to better problem solving and more creative solutions.

Skills & attributes

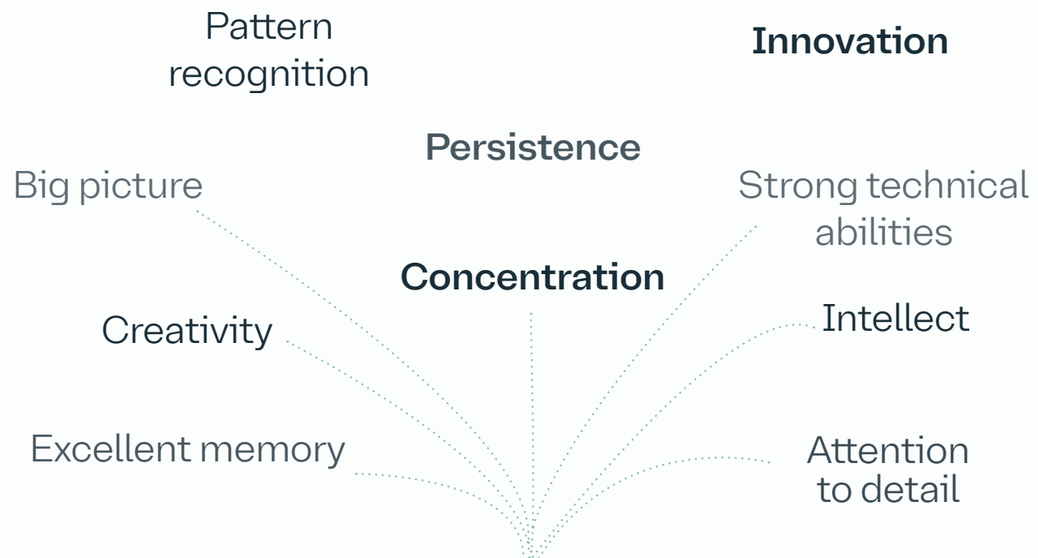
According to The Brain Charity, as well as their individual strengths, neurodivergent employees often possess highly desirable skills and attributes, such as:

- Reliability, conscientiousness, and persistence;
- High levels of concentration;
- Detailed factual knowledge and an excellent memory;
- Attention to detail and the ability to identify errors;
- Strong technical abilities in their specialist areas;
- Creativity, especially in visual or spatial or process activities;
- High levels of intellect;
- The ability to look at the bigger picture and think laterally.

However, neurodiverse people with higher sensitivity to physical surroundings are more likely than others to experience stress and anxiety working in crowded, noisy, open plan offices and can find it hard to focus and collaborate with confidence.

Workplaces designed only with neurotypicals in mind can cause employers to unintentionally exclude or discard great talent.

Therefore, it is important to design an office that takes the needs of neurodiverse individuals into consideration so that they can perform to the best of their ability and allow their unique talents to shine. Furthermore, studies show that reasonable adjustments made for neurodivergent individuals often benefit everyone and lead to improved productivity.



1 in 7 people are likely neurodivergent in some way

Neurodivergent employees can possess highly desirable skills and attributes

Workplace barriers to neuroinclusion

Neurodiversity is the natural variation in human neurocognition, person to person. In simpler terms: we all think in different ways. We all process information, or sensory input, differently. This is because our brains are unique. Several factors also influence its neurocognition, from personality to cultural upbringing to age. Neuroprocessing is done in conjunction with several senses:

- Visual;
- Auditory;
- Olfactory (smell);
- Gustatory (taste);
- Tactile (touch);
- Temperature;
- Vestibular (balance);
- Proprioception (body position);
- Interception (internal body awareness);
- Chronographic sense of time.

Sensory sensitivities

People with neurodivergent conditions may experience spaces differently or to a more amplified extent than other members of the population. They may experience some form of sensory sensitivity due to functional hyper-connectivity across multiple brain regions, and/or difficulty filtering sensory signals which may make the individual prone to feeling overwhelmed and anxious in certain environments.

Although some may be affected, it is important to acknowledge that not everyone will be affected to the same degree and that some individuals may even need higher levels of sensory stimulation to function or be surprisingly unaffected by what would cause stress in others. Similarly, it is also important to understand neurotypical people can be regularly or intermittently affected by one or many of the sensitivities listed.

Fluctuating sensory inputs can make it challenging for some and many neurodivergent employees may struggle more than neurotypicals to function in a typical open plan office where sensory distractions may lead to loss of focus, productivity and in some cases cause discomfort, pain, stress, anxiety, and absenteeism. These may also be an indication of an underlying undiagnosed neurodivergent condition.

People with sensory or mobility impairments can experience greater difficulties in some sensory environments owing to cognitive effort that is required to make the most of one's available senses or mobility. Some may struggle to decipher speech in a noisy environment, or may be sensitive to smells and patterns, sudden movement, bright, flickering, unnatural lighting, and glare. However, it is also important to remember that everyone is different, and a design that suits one employee may not suit everyone. Therefore, it is important to create environments that suite a wider spectrum of people and provide choice.

Sensory sensitivities can include:

Sound

Some may struggle to concentrate or make out speech in a noisy environment

Lighting

Some people with dyspraxia and autism may be more sensitive to light

Movement

Whilst distracting for some, movement can also help those with attention disorders to focus

Patterns

Large areas of repetitive patterns can cause migraines and effect balance

Smells

Some are more sensitive to smells, and some may become overwhelmed by some scents

Temperature

Sensitivity to heat or cold, is common across a range of conditions

Sensory zoning

Hypersensitive and Hyposensitive

Whether neurotypical or neurodivergent all people fall somewhere on a hypersensitive through to hyposensitive spectrum of response to sensory stimulation in the workplace. Hypersensitive people can for example prefer environments that are quiet and /or clean, aren't overcrowded, and/or have simple, neutral patterns and colours. On the other side of the spectrum, people that are hyposensitive may like busy environments with excitement, noise, bright colours, and places to move around. The ideal place for concentration, collaboration or meeting space may be very different considering where someone falls on the hypo- and hypersensitive scale. Some individuals are both hyposensitive to some sensory stimulation while being hypersensitive to others.

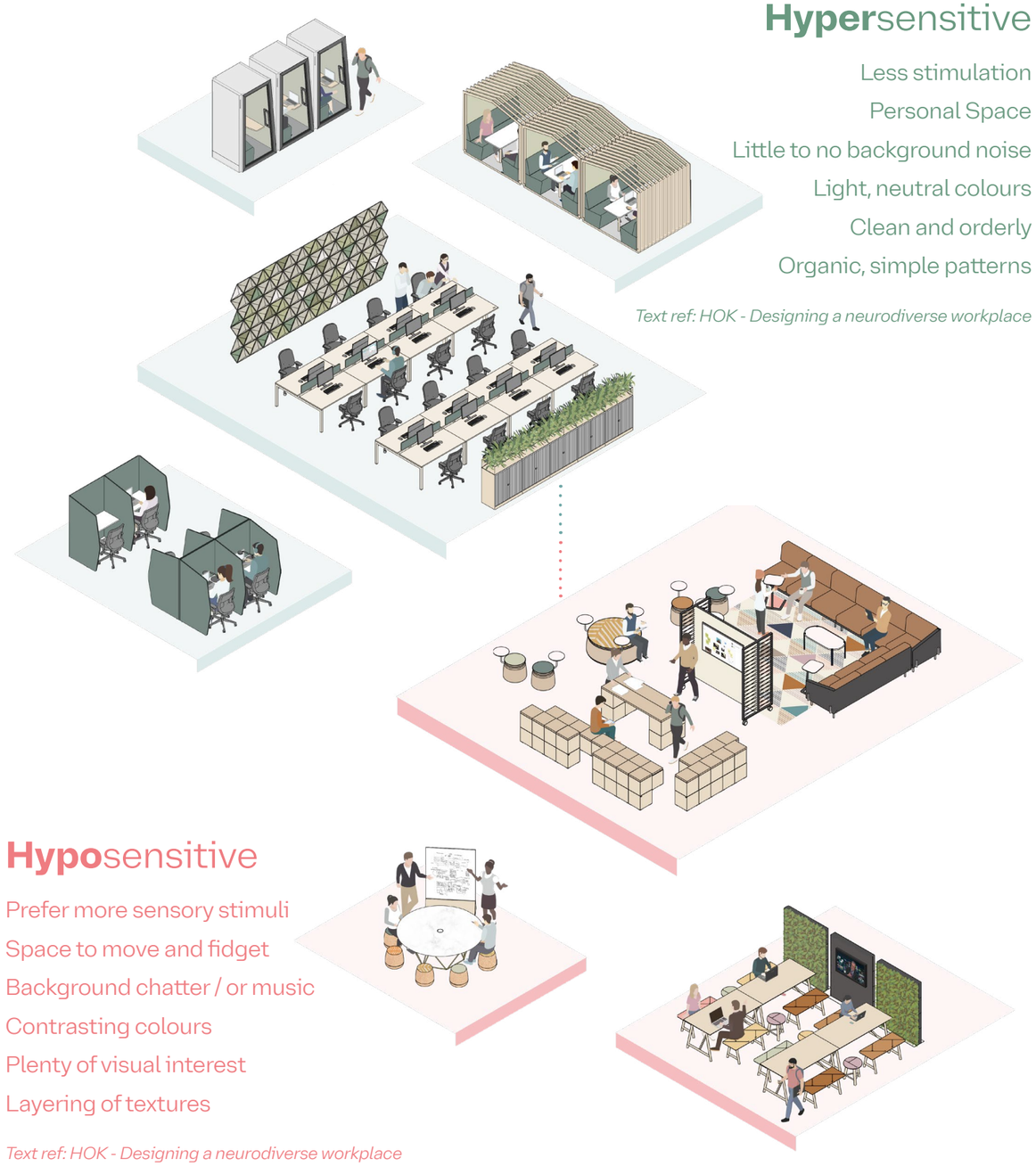
Degrees of stimulation

Just as a person with different physical challenges requires unique solutions tailored to their needs, so is the case with neurodivergent people. Creating options to control or choose the degree of sensory stimulation should be a key aspect of inclusive design. The workplace should provide options that can accommodate the needs of different individuals, or even the same individual on different days dependant on the task at hand. These should include spaces which support team collaboration, quiet reflection, focused thinking and relaxation and should be distinct in terms of light, sound, and visuals. By providing a variety of sensory landscapes and controls you allow employee's the opportunity to select the right zone and/or adjustments to support their needs.

In general, workspaces should presume to be calm, and include quieter focus areas. They should generally be more neutral environments incorporating biophilic design and avoid busy artificial patterns to help reduce sensory stress and thereby decrease the potential for anxiety. The use of distinct colour will help wayfinding and place making but should be limited to small and judicious signature elements and be generally muted in tone. Focus and quiet zones should be especially peaceful places with lower stimulation, providing opportunities for sensory escape or breaks. Similarly, workspace desks should be located away from heavy footfall, ideally close to windows with natural light and views out of the building with good sunlight and daylight controls.

More vibrant, and visually busy and colourful designs which incorporate higher levels of stimuli can then be reserved for spaces that people elect to go. These spaces should be destinations , not on route to other locations and be situated away from the general work areas where possible. However, it should not be assumed that all collaboration and social spaces where employees congregate feature higher levels of stimulus as this would exclude effective participation of neurodivergent people.

- Create calm areas first and then smaller and specific destination locations with different degrees and characters of stimulation.
- Avoid busy patterns and colour choices at workstations, places of focus, circulation, and entrances;
- Reserve more stimulating designs for specific spaces that people can elect to use.



Hypersensitive

Less stimulation
Personal Space
Little to no background noise
Light, neutral colours
Clean and orderly
Organic, simple patterns

Text ref: HOK - Designing a neurodiverse workplace

Hyposensitive

Prefer more sensory stimuli
Space to move and fidget
Background chatter / or music
Contrasting colours
Plenty of visual interest
Layering of textures

Text ref: HOK - Designing a neurodiverse workplace

Choice, control, flexibility & behaviours

Choice

A sense of control can be vital to some neurodivergent's sense of well-being, security and capacity to concentrate, therefore the inclusive workplace should aim to:

- Reduce the potential for sensory overload or distress from features within the built environment;
- Provide flexibility and choice to meet a spectrum of requirements;
- Offer places for recovery and respite when needed.

Reference: PAS 6463:2022 Design for the mind

The workplace should provide a variety of settings and options for individuals, coupled with some degree of personal adjustments to address further specific needs. Essentially employees should have autonomy over their space and the ability to control their immediate surroundings. This may be difficult to achieve across an entire office, but by providing a variety of workplace settings, and a mix of both bookable and hot desk scenarios, the workplace can help reduce anxiety by providing opportunities for employees to book seats in different locations within the office, such as away from doors, windows, glare, displays, printers, tea bays and odours. For some individuals, specific desks reserved for their use when in, will be necessary.

Control & Flexibility

In some cases, a design intervention to improve the environment for one type of sensory difference might be to the detriment of another, therefore provision of spaces with the ability to adjust the environment is also recommended. Consider providing areas with ergonomic furniture, acoustic partitioning, adjustable lighting and airflow. For example by providing enclosed acoustic pods and booths you can create opportunities for people to move between enclosed and open spaces at will. In addition to specific quiet rooms these spaces can become places of respite and refuge reducing the potential for sensory overload and ultimately promoting higher productivity.

As well as autonomy over space and work environments autonomy over schedules should also be considered. Allow employees the freedom to work not only where but also when they feel they will be the most productive, with work from home and flexi hours for those who prefer to work in the office when it is quieter and less busy.

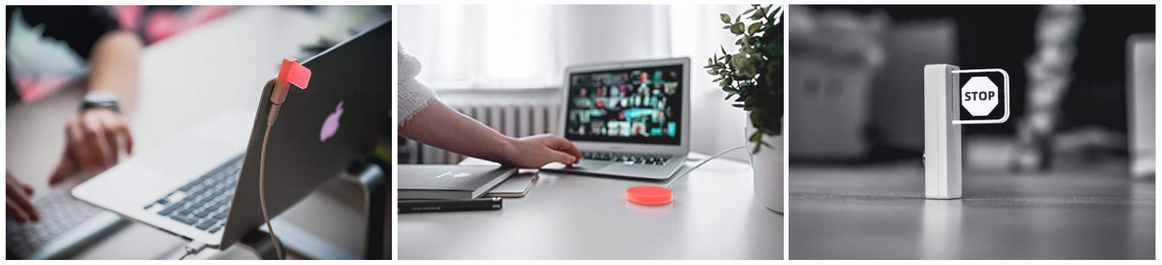
- Allow employees autonomy over their space & schedules;
- Provide a mix of bookable and hot desk seating, allowing for some allocated provision;
- Provide environments where individuals can control sound, daylight, light & airflow;
- Offer flexible working hours.

Behaviours

Whilst providing a variety of settings, it is also important to communicate an agreed work culture or set of expected behaviours within the different workspaces. Consider introducing tech-free zones to limit disturbances from colleagues' teams calls or mobile phone conversations. These spaces could be labelled as 'library'-style zones across the building, helping to communicate a clear expectation of colleague behaviours. Reinforce guidelines with staff inductions, supporting graphics to nearby walls and desk notices. Furthermore, by developing an online seat booking systems to filter seats by activity or noise level you can help ensure staff are booking the optimal workspace for their needs. Also consider building in booking prompts or polite reminders of the guidelines and expected behaviour when booking seats within quieter work zones and providing visitors with a briefing card outlining options and expected behaviour.

For those working in more open plan settings, provide the ability for employees to give non-verbal cues. This may be through providing desk-top indicators that suggest whether people are open to communication or would rather be left alone to work. Desk-top markers can help people non-verbally signify when they are happy to interact with others and when they would like to work without disturbance.

- Consider creating tech free or library zones where phone calls and meetings are discouraged;
- Develop online seating booking system to show activity maps highlighting quiet and active zones;
- Provide booking prompts to reinstate expected behaviour when booking seats within designated zones;
- Ensure that library or tech free zones are clearly labelled with wall graphics and desk notices;
- Consider desk-top indicators to help staff communicate when they are happy to interact with others and when they would like to work without disturbance;
- Provide a confidential way for staff to report back if their well-being is being affected, and if colleagues are not adhering to guidelines.



Selection of Luxafor availability indicators, including options for the colour-blind

Spatial layout

Variety of workspaces

A variety of work settings should be at the heart of an inclusive office design. Employees should be able to work in the zones that support their preferences and needs, for example those who experience social anxiety or are prone to sensory overload should have access to wrap around booths or a private pod that they can work within when they feel overwhelmed. These spaces should allow people to work on their own, but without feeling completely isolated. They should provide no less functionality than conventional desks and incorporate opportunities for two screens, task lighting and height adjustable desk and chairs.

Consider also providing places to rest that are separate from the main social spaces and kitchens, ideally these spaces should be calm, uncluttered with a door and be highly adjustable. These spaces should be low in stimuli and be refuges where people can find relief from stress and sensory overload. The space does not have to be silent but should be designed in a way to promote relaxation.

- Enable employees to manage their sensory sensitivities by providing a range and varied type of workspaces;
- Allow employees the freedom to select these workspaces based on their needs or the task at hand;
- Provide varying and flexible arrangements for socialising and independent focused work;
- Create quiet work zones within the office floor plate, away where possible from busy areas;
- Offer options for working in both semi-enclosed and fully enclosed pods for privacy;
- Create active zones for collaboration with higher levels of stimulation and flexible furniture;
- Consider creating a dedicated rest room separate from social and kitchen spaces where people can find relief from stress and sensory overload;
- Introduce changeable lighting and optional and controllable nature sounds or soothing music.

Movement

As well as the importance of creating places for focus and concentration, an inclusive office should also cater for the kinaesthetic needs of employees. Kinaesthetic learners for example prefer to be actively engaged, they use body movement and interact with their environments whilst learning. Similarly some neurodivergent people require movement and repositioning to maintain concentration and mental health. Movement can help those with attention disorders to focus, allow them to release energy, ease their mind, and help them stay more locked in on the activity at hand.

- Provide active zones that foster movement with furniture that allows swinging, bouncing and rocking along with mobile whiteboards, and space to pace, stretch and move;
- Invest in ergonomic furniture that supports movement at the desk like footrests, active chairs, and sit-stand desks;
- Provide opportunities for dual monitors, which can assist with organization and information retention.

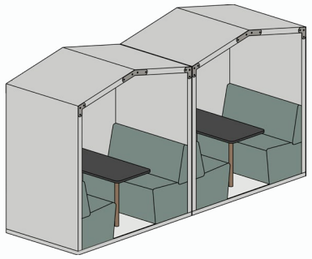
Variety of workspaces include:

Privacy

Enclosed pods for independent work with sound control, adjustable lighting & airflow, with larger options enabling mobility access

Focus

Low stimulation zones with adjustable lighting and acoustic panels but with no less scope and functionality as conventional workstations



Respite

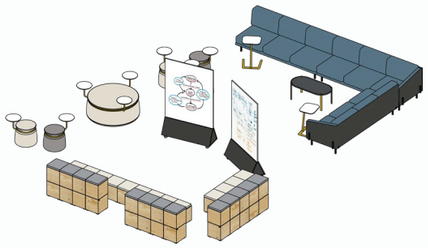
Semi enclosed points of refuge providing opportunities to move away from the workstation

Movement

Within focused seating zones provide a selection of active chairs, sit-stand desks & footstools to help aid focus and boost productivity

Collaboration

Design a variety of active zone's with movable furniture, writeable surfaces. and acoustic partitions



Social

Create flexible and social zone's with hands-on tactile furniture. Provide choice between zones with higher and lower levels of stimulus

Spatial layout

Zoning & Sequencing

Careful consideration should be given to the sequencing and zoning of hyposensitive and hypersensitive settings. The location and arrangement should avoid confliction, ensuring that quiet areas for concentration are located away from potentially louder collaboration zones. However enable equitable and neurodiverse engagement by providing choice between calmer collaborative areas and areas with more stimulus.

Adequate space circulation should be provided within the floor plan and employees should not be forced to sit in the middle of a large space with their backs towards activity or people moving around as this can cause stress and potentially anxiety.

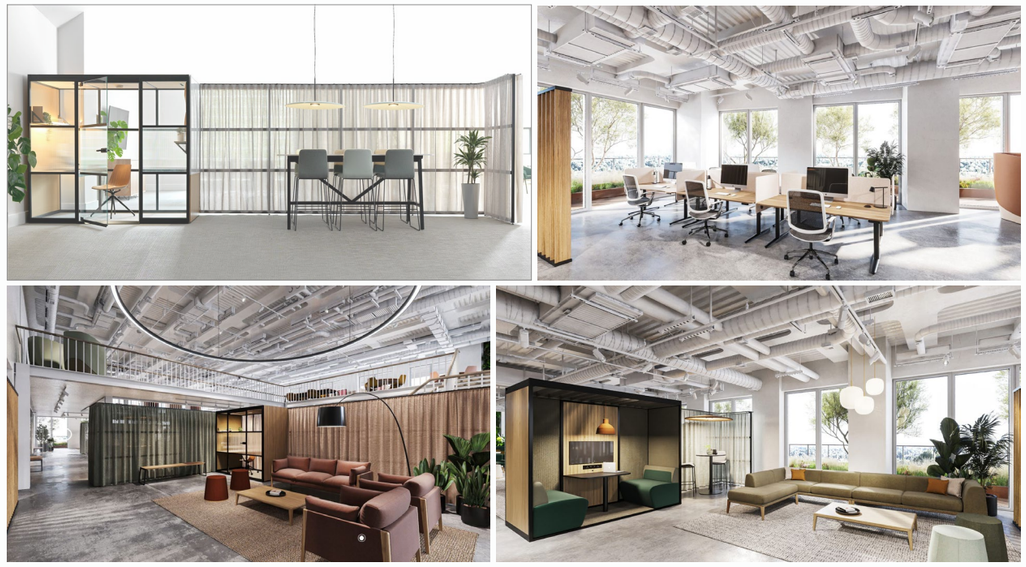
- Zoning provides choice and potentially helps prevents sensory overload, and can aid wayfinding;
- Some zones should be more open and potentially more social, while others should be closed and more private;
- Quiet / focus/library zones should be quieter and limited in stimuli & located away from busy areas;
- Some and not all active zones can be high-energy, high stimuli and offer hands-on tactile elements but most should be dialled back to enable equitable participation;
- Consider varying ceiling heights, within some zones with lower ceiling's in more intimate quiet spaces.

Wayfinding

Wayfinding systems are important to be able to navigate easily and intuitively understand spaces. Systems that rely on only a single sense, such as visual signage, may not meet the needs of some users. Therefore, Information and wayfinding should be provided based on the principle of not just signage but placemaking too. Differences in more than one sensory realm (visual, auditory and tactile) can further aid navigation.

The opportunity to accurately anticipate and experience an environment virtually may help to reduce anxiety so consider website digital walkthroughs or wayfinding aids with audio description that can be accessed through employees' handheld devices.

- Each zone or space should be intuitive and easy to navigate with clear, consistent signage;
- Consider displaying a simple plan of the interior at the entrance to help reduce anxiety, or produce a website friendly digital walkthrough of the building to allow people to do a dry run of their route;
- Offer wayfinding markers adjacent to doors and entrances to set a sense of place and context;
- Avoid signs which include multiple different colours as they may overload the senses;
- Where colour coding is seen as a helpful indicator, designers should also create a symbol
- Provide clear alternative routes that allow the option to bypass particularly busy spaces, corridors, and lobbies where possible;
- Provide heat maps of busy times;
- Use repeated design features to create a reassuring sense of order and familiarity;
- Use strong but judicially executed focal points like artwork, colours, feature, and green walls to help employees orient themselves and act as memorable landmarks;
- Colour coding to zones on a floor and amenities with different types of floor surface to distinguish between circulation routes and destinations can be a helpful aid for some, but remain mindful of creating visual barriers and noise. Consider other means of distinguishing floors too;
- Avoid the use of highly contrasting/ alternating and busy patterns for flooring and walls, especially general circulation areas;
- Use appropriate lighting to help aid navigation and avoid glare.



Above: Boss Design. various ranges. Example of zoning large open plan office into a series of open, enclosed and semi-enclosed spaces with a mix of social, collaboration, work and relaxation zones.

Sounds

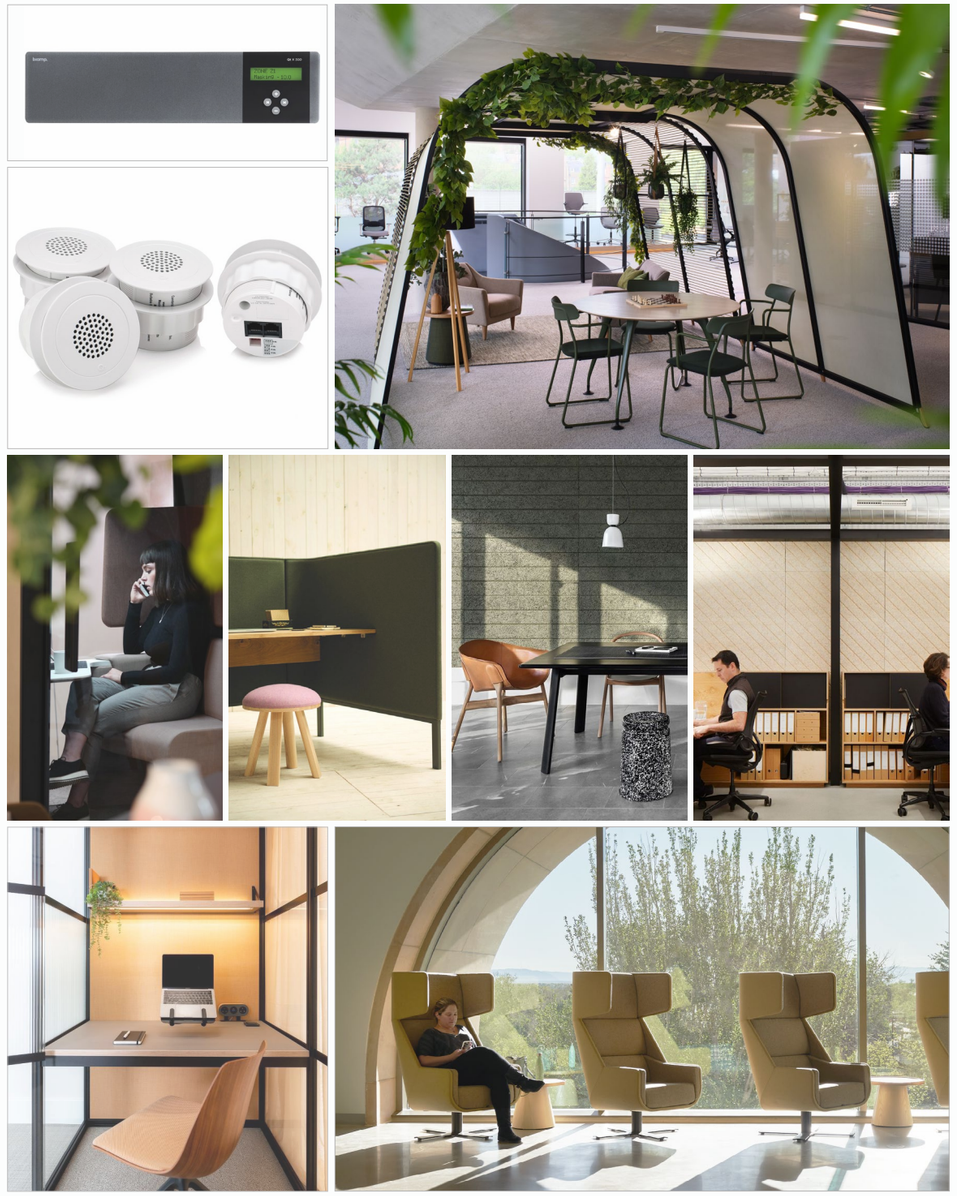
Acoustics

Many neurotypical employees may find ambient noise or the lack of it counterproductive, however an employee who is especially sensitive or prone to distraction, such as those with autism or ADHD, can find it distressing. Whilst many neurotypical people can adjust to a variation in noise levels, this can be much harder for individuals with a range of sensory processing differences. The types of noise people are sensitive to are different for different people, it may be a continuous, intermittent, unexpected, high volume, or specific frequencies of noise.

In an open-plan environment special consideration should be given to the zoning and sequencing of acoustic zones. The space should provide a variety of auditory settings in support of a diverse range of activities, all located appropriately to one another. Noisy office equipment such as printers, server rooms and coffee machines should be located within reasonable convenience but away from quiet and focused workspaces and where possible in different rooms. Acoustic buffering between different work settings can be achieved through careful selection of materials and furniture pieces. For example, fabric covered seating pods with extended high backs can create a visual divide between zones whilst providing sound absorption to help soften and diffuse sound.

At the other end of the acoustic range, an office space can sometime become too quiet. Without low-level, ambient background noise to absorb them, softer sounds such as a continuous hum, ticking clock or dripping tap can be amplified. In these situations, and if there are no alternatives then a sound masking or white noise system may be beneficial. Sound masking can carefully raise ambient background noise levels within offices to improve the acoustics, help aid concentration and increase speech privacy and production levels. However, care should be taken, and these should not be used to overcome fundamental issues that can otherwise be designed out.

- Position workspaces, especially quiet desk areas in low-traffic areas;
- Consider an active noise cancelling or sound masking system, but not as a first resort;
- Offer quiet rooms and private work pods for intense concentration;
- Finish each office zone with acoustic dampening materials like baffles, and panels;
- Where spaces are inherently reverberant, consider using softer materials on floors, walls, and ceilings to reduce noise reflection;
- Consider acoustic zoning and allow for a gradual transition from quiet to noisy areas;
- Choose soft furnishings with fabrics that help absorb noise;
- Use dividers or upholstered high back furniture pieces to block and reduce unwanted noise;
- Encourage employees to use noise-cancelling headphones if desired, but do not assume that this is always the answer as individuals can get overheated if they use them all the time;
- Use planting strategically to help dampen noise, as the leaves, stems, and branches absorb, deflect, and refract sound.



Above: Images of discreet sound masking systems solutions by Acoustic Comfort and Pro Acoustics, Orangebox On the QT privacy pods, Orangebox Campers & Den, Buzzispace BuzziTemp , Baux acoustic wall panels, Boss Design Mews, Buzzispace Buzzime.

Visual noise

Visual distractions

Some people struggle to concentrate if the workplace features highly repetitive or busy patterns, or is chaotic and cluttered, and some people with sensory and information processing differences are sensitive and observant of details. A cluttered environment can become overwhelming and distracting for these individuals as there is too much visual information to process.

Similarly other individuals require and prefer visual stimulation, movement and noise which may be distracting for others. Hot-desking arrangements, where an individual is allocated a desk in a different position every day, may cause anxiety for someone who is hypersensitive. Therefore, consider incorporating sensory mapping in booking systems to indicate not only the desk and chair type but also the environment for each location, for example busy collaborative area and quiet focused working.

- Improve visual privacy and mitigate distracting visual movement by providing some areas with mobile partitions and desktop dividers;
- Use biophilic design elements such as planting to break up unnecessary visual sight lines;
- Allow employees to book seats away from doors, windows, displays, printers, and tea bays if preferred;
- Reduce visual clutter, provide storage space, and promote a clean desk policy, whilst permitting and encouraging appropriate personalisation of space when occupied;
- Eliminate or cover devices and equipment that flash.

Lighting

The application of lighting has a significant impact on wellbeing. Research has shown that levels and types of lighting can affect emotions, decision making, productivity, awareness of time and circadian rhythms. Increased access to controllable daylight can help to reduce stress and increase physical and emotional well-being. Therefore, daylight should be made available where possible, however the potential for glare should also be identified. Avoid positioning workstations facing or backing onto windows, and specify glare reducing film, black out blinds, or curtains where appropriate.

It is also important to acknowledge that those who experience sensory overload often have significantly heightened sensitivity to light and can be adversely affected by flickering, illumination levels, colour, and positioning. Where possible, provide a range of lighting setups, such as desktop lamps, floor lamps, up lighting wall units and overhead lighting. Measures should be taken to subdue the intensity or direct viewing of the light source, and elements such as diffusers or recessed light sources with reflector technologies that don't themselves cause glare or visual noise should be used.

Finally allow individuals to make adjustments to meet their specific requirements wherever possible. Provide spaces with options to dim lights to lower levels or adjust colour temperature from warm to cool. Importantly artificial lights should not flicker or hum as this may also impact those with heightened visual or auditory sensitivities negatively.

- Ensure workspaces aren't lit too brightly;
- Offer adjustable lighting where possible;
- Consider providing a combination of fixed and task lights;
- Ensure lighting does not flicker or hum;
- Avoid concentrated light sources and visibility of strings of LED's;
- When specifying LEDs make sure that there is a good colour balance and that there is avoidance of the effect of a blue spike in their output;
- Limit light pollution or undue light spill onto adjacent areas;
- Let natural light flood select spots in the office;
- Minimize glare from windows with glare-reducing film, blinds, or curtains;
- Fast moving or changing light effects should be avoided or introduced with consultation;
- Be mindful of sharp changes in colour/tone in floor treatment or shadows as they can be misinterpreted as a barrier or obstruction;
- Be mindful too of patterns created by shadows and cast by lighting through objects and screens.

Above: Senator Adapt lightweight adapt walls, examples of desktop planting to help mitigate visual distractions, Boss Snug Focus booth with pendant & task lighting, Fovi Relic table with lights and felt screen divider.

Visual noise

Patterns, colour & biophilla

The visual environment can have an impact on comfort and the ability to function within a space, certain patterns and arrangements of form can be difficult to process. For those with high sensory receptivity, repeating patterns and forms can cause significant reactions such as anxiety, migraines, loss of balance and adverse depth perception. Even individuals who are not particularly effected by the impact of adverse patterns, can loose a degree of brain activity to the filtering process.

Further research is still required within this field, however common sources of visual discomfort can be found in the following:

- Highly repetitive and busy patterned finishes;
- Tiling with gloss finish and accentuated joints;
- Louvres, slats and battens;
- Perforated sheet' materials;
- Railings;
- Overly contrasting stair nosing;
- Entrance mats.

Problems can occur when repeating geometric forms such as stripes, bars, and perforated materials are used and may appear to shimmer or move when viewed. Designers need to take care to ensure that patterning along circulation routes does not create a flicker rate within sensitive ranges, typically 16 Hz to 25 Hz as this may trigger seizures in those with photosensitive epilepsy. Migraine and other indicators of sensory overload may also occur. The effect can be amplified if there is an increase in contrast between foreground and background and also if the background is intensely lit.

Large areas of floor, walls and ceilings should be reviewed for visual discomfort. 3D modelling and virtual flythroughs can assist and should be utilised to review large areas to assess their impact. As a rule of thumb if the digitized image of pattern give rise to moire patterns and other detracting visual effects, the chances are there could be a problem. Although this field is still evolving the following should be considered when evaluating visual discomfort:

- Large areas of stripes and geometric patterns with high contrast;
- Equally spaced and sized repeating elements of high luminant or chromatic contrast;
- Uncomfortable patterns in three dimensional forms.

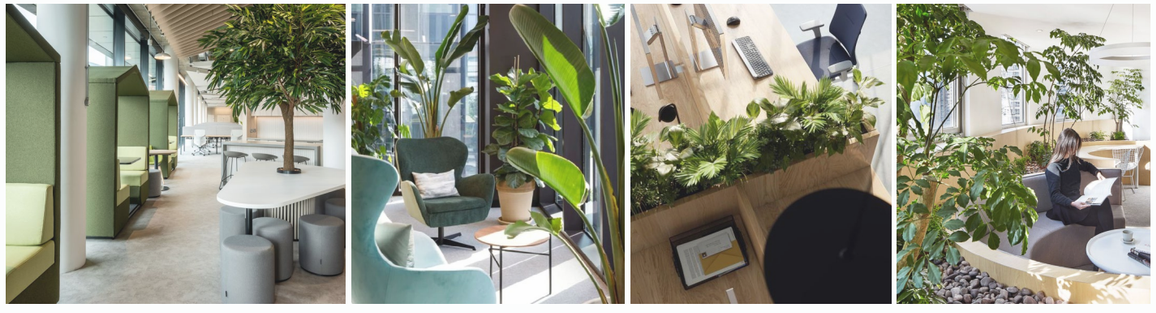
A general accepted rule is that the most uncomfortable pattern occurs when six black and six white stripes fit within the width of a thumb when held out at arms-length. However, it can be difficult to gauge the potential effects of the materials selected during the design stage. It is therefore recommended presenting proposals with a range of end users, including people who experience sensory overload, before making a final selection of a patterned finish.

- Compile a mood board that includes all finishes in an area together;
- Produce visuals with accurately scaled materials so end-users can view designs in advance;
- Consider creating a fly-through video to simulate how the finishes might appear in reality.

Many features that are generally associated with mental wellbeing can also be beneficial to people who experience sensory differences. Incorporating biophilic concepts in work environments based on the use of natural elements, forms, materials, and plants can help reduce anxiety. They contain low levels of visual noise which is easier for the brain to process, and it is thought that the frequencies in natural patterns that would otherwise generate visual noise, cancel themselves out. They provide stimulus but of a form that our brains are more suited to processing and indeed find positive. Combining views of outside spaces with indoor biophilic features provides the maximum benefit however calming images, artwork and living plants can also be effective.

The following should be considered to help reduce visual noise:

- Minimise sensory overload by avoiding highly repetitive and busy pattens, be mindful in the selection and use of colours and tones;
- Avoid patterns that resemble motion blur;
- Consider reducing tonal contrast between a pattern and its background or use muted colours to reduce the visual noise;
- Keep the peripheral visual field clear of bold patterns where people are likely to sit for longer periods;
- Lower visual content in key areas such as communication points and quiet / focus spaces;
- Ensure patterning along circulation routes do not create a flicker rate within sensitive ranges;
- Combine views to the outside alongside indoor biophilic features where possible;
- Connect with nature with organic forms and textures;
- Use natural finishes, materials, and avoid complex, repetitive and bold linear patterns;
- To promote calm and decrease anxiety use colours that occur in nature, such as browns, greens, and blues. If using reds and yellows use judicially and in muted and more earthy tones;
- Introduce living plants to assist in reducing anxiety and discomfort, but be mindful not to select plants with strong and distinctive scents such as lavender, and avoid spiky plants such as cacti.



Above: The soloist, ply design, The Architects Muxin Design, Photographs Zhang Daqi

Sensory feedback

Materials

When selecting finishes it is best to avoid large areas of reflective materials such as some metals or glazing, as these cause discomfort and glare. Shiny floors can create reflections from overhead lights and bright sunlight, which can increase discomfort and glare for people with higher sensitivity to bright light, this in turn can cause confusion and potentially contribute to the level of visual noise and sensory overload. Instead opt for matt and low sheen floor and wall surfaces where possible as this will make it easier to navigate and less stressful.

The appearance of different floor finishes can impact on how people navigate an environment. Hypersensitivity to visual noise, or a vestibular (balance) condition, can result in some people being disorientated or having difficulty in navigating some floor finishes. Adjacent floor surfaces that contrast in appearance might result in a border line or edge that some people might not understand, or may create difficulty initiating movement. However, there are occasions where it is beneficial to have two visually distinct surfaces. In these instances, consider the transition carefully and avoid banding or visual confusion between the two primary surfaces to minimize the risk of misinterpretation.

Repetitive floor patterns, including strong linear or striped designs, across large areas, such as long corridors or big spaces, should be carefully assessed to avoid negatively affecting people with balance conditions as they move across the floor. Patterned floor tiles laid in a format that creates a mosaic effect (such as rotating alternate tiles), should also be assessed for the potential to cause visual or vestibular (balance) disturbance. Opting for no rotation or reducing the visual contrast within the pattern may lower the risk.

Most people (although many don't recognise that they are doing it) and especially some neurodivergent people like to 'stim', this is where they seek sensory input to self-soothe or simply because it's enjoyable. For example people will often seek out music, sounds, olfactory or visual stimulus. For some people the textures around them can be a big part of that, and fidgeting with small items or stroking a smooth surface can be relaxing. Therefore, careful consideration should be taken with the materials specified. Soft, smooth textures can be comforting, whereas some may seek out rough,and scratchy textures. Nevertheless some textures can be problematic if utilised on surfaces that people cannot avoid.

- Contrasting, transitional, colour coding of floor surfaces should be carefully considered in the context of building users and designed accordingly;
- Tonal contrast between elements to aid navigation and viability by partially sighted people should always be feature in the design;
- Transitions should match the tones of both flooring surfaces, to avoid creating the impression of a step or level change;
- Avoid shiny or visually contrasting transition strips as they can cause confusion for some people;
- Be cautious of mosaic effect /rotated alternate carpet patterns and asses them carefully for potential visual or vestibular disturbance;
- Entrance mat system with an intermediate colour, should aid the transition between indoor and outdoor contrasting surfaces, however do not use highly contrasting brush and holders as this is very visually noisy;
- Avoid large areas of reflective materials and be careful even with small areas;
- Select furniture that is soft to touch;
- Rough, scratchy textures can be problematic;
- Natural materials are often more comprehensible, calming and uplifting than synthetic counterpart's.

Examples of natural organic, non-directional carpet patterns for large areas. Carpet shown Interface Composure / recreation inspired by natural rock formations. Fabric stool is Dolly in Camira as shown above.

Sensory feedback

Thermal comfort

Thermal comfort consistently ranks on workplace surveys as one of the top environmental irritants and research has found that it can have a significant impact on productivity. Comfort levels can vary making it difficult to design a space with the correct levels for everyone.

A temperature ranging from 19 °C to 23 °C should be provided for passive occupancy, where possible, with an ability for users to make adjustments within this range. However there are many personal factors involved in thermal comfort such as clothing, activity level and metabolism, as well as neurology. One solution to this challenge is to provide individual temperature controls, such as an operable window or air diffuser, to enable workers to adjust their thermal environment to their liking.

Consider the following:

- Heat recovery systems to assist in providing fresh air;
- Ensure optimal humidity and airflow through the space;
- Ensure consistent yet programmable heating and cooling ‘zones’ with an adequate user-friendly interface;
- Design thermally varied spaces, such as a naturally ventilated atrium or an outdoor patio, so people can choose a location that suits their thermal preference;
- Control solar gains in perimeter spaces so people beside the windows don’t overheat;
- Improve the performance of the building envelope for even conditioning throughout the space;
- Consider investing in desktop air purifiers, fans, and heaters for those who may require them;
- Bring in more plants to clean and freshen the air, help achieve target humidity levels, help reduce stress and increase wellbeing.

Air Quality & Odour

Hypersensitivity to odour is common in autistic and other neurodivergent groups and can cause discomfort. Internal layouts should consider key sources of unwanted and unexpected odours from catering, dining, bins, and WC’s. The layout should be assessed so that the location of these facilities does not directly impact workspaces. Opening of doors and windows can provide ways to reduce the effect, however sufficient filtration and ventilation systems should be specified to prevent such odours from reaching adjacent areas.

Careful consideration should also be given to the material’s specified, such as floor finishes. Some flooring types can result in odours being emitted into the atmosphere during installation and for varying periods of time afterwards. Consider offsetting this with air purifying plants such as areca palm or snake plants which absorb toxins and release more oxygen into the room.

The following actions should prevent discomfort:

- Regularly service the HVAC to facilitate healthy air quality and circulation to limit any intrusive smells;
- Limit the use of construction materials and finishes containing toxins or emitting volatile organic compounds (VOCs) and semi-volatile compounds (SVOCs);
- Where possible, select carpets that are free of adverse chemicals with a low pile;
- Select low-VOC or water-based adhesive products if used;
- Introduce plants that help to reduce VOCs, such as bamboo palm, areca palm or snake plants which absorb toxins and release more oxygen into the room;
- Install louvres and/or openable windows where possible to facilitate purging and ventilation.

The inclusive office

Wellbeing & Welfare

Dedicated welfare room and a separate wellbeing room. The wellbeing room should function as a quiet room and be a tranquil and relaxing lounge space with flexible and customisable features for different users' sensory needs.

Social / Collaboration Zones

Calm, inclusive, low stimulation social and collaboration zone which provides opportunities for collaboration and space to move and fidget.

Reception

Opposite entrance area, a welcoming point for all visitors and employees. A calm space that avoids visual noise and sensory stress.

Reprographics

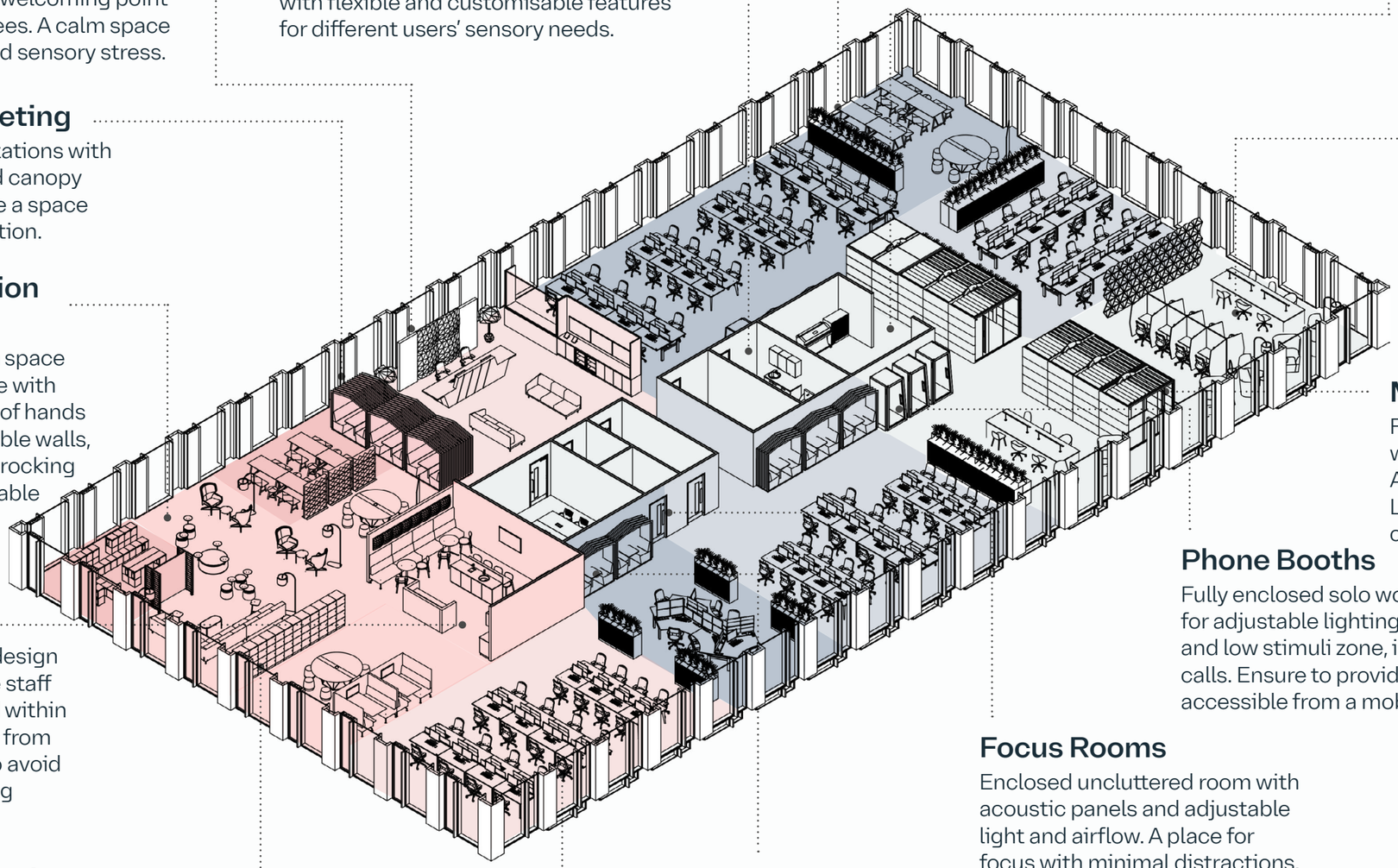
Ideally located in a separate room and a reasonable distance from workstations and quiet / focused workspaces.

Semi-enclosed Meeting

Located away form workstations with AV provision and overhead canopy for privacy. Can help divide a space and provide sound absorption.

Focus Zones

Located at the furthest point away from social, collaboration and tea bay zones. Mixture of solo working, with acoustic panels and adjustable lighting.



Social / Collaboration Zones

A secondary collaboration space and active movement zone with opportunities for a variety of hands on, tactile furniture, writeable walls, acoustic dividers, wobble, rocking and balance chairs. Adaptable with deployable levels of stimulation.

Meeting's

Fully enclosed and adjustable workspaces with dimmable lights, AV screens and adjustable airflow. Low stimulation interior to help aid concentration over long periods.

Phone Booths

Fully enclosed solo working booths with options for adjustable lighting and airflow. Acoustic and low stimuli zone, ideal for private phone calls. Ensure to provide equivalent which is accessible from a mobility perspective.

Teabay

A social space distinct in design and dedicated zone where staff can prepare food. Located within the active zones and away from focus and quiet working to avoid noise and smells disturbing those who are sensitive.

Focus Rooms

Enclosed uncluttered room with acoustic panels and adjustable light and airflow. A place for focus with minimal distractions.

Lockers & Collaboration

Located within active zones and away from focus and quiet working zones.

Workstations

Located close to windows for natural daylight with adequate provision of dual screens throughout the office along with sit-stand desks, active stools, and footrests.

Respite

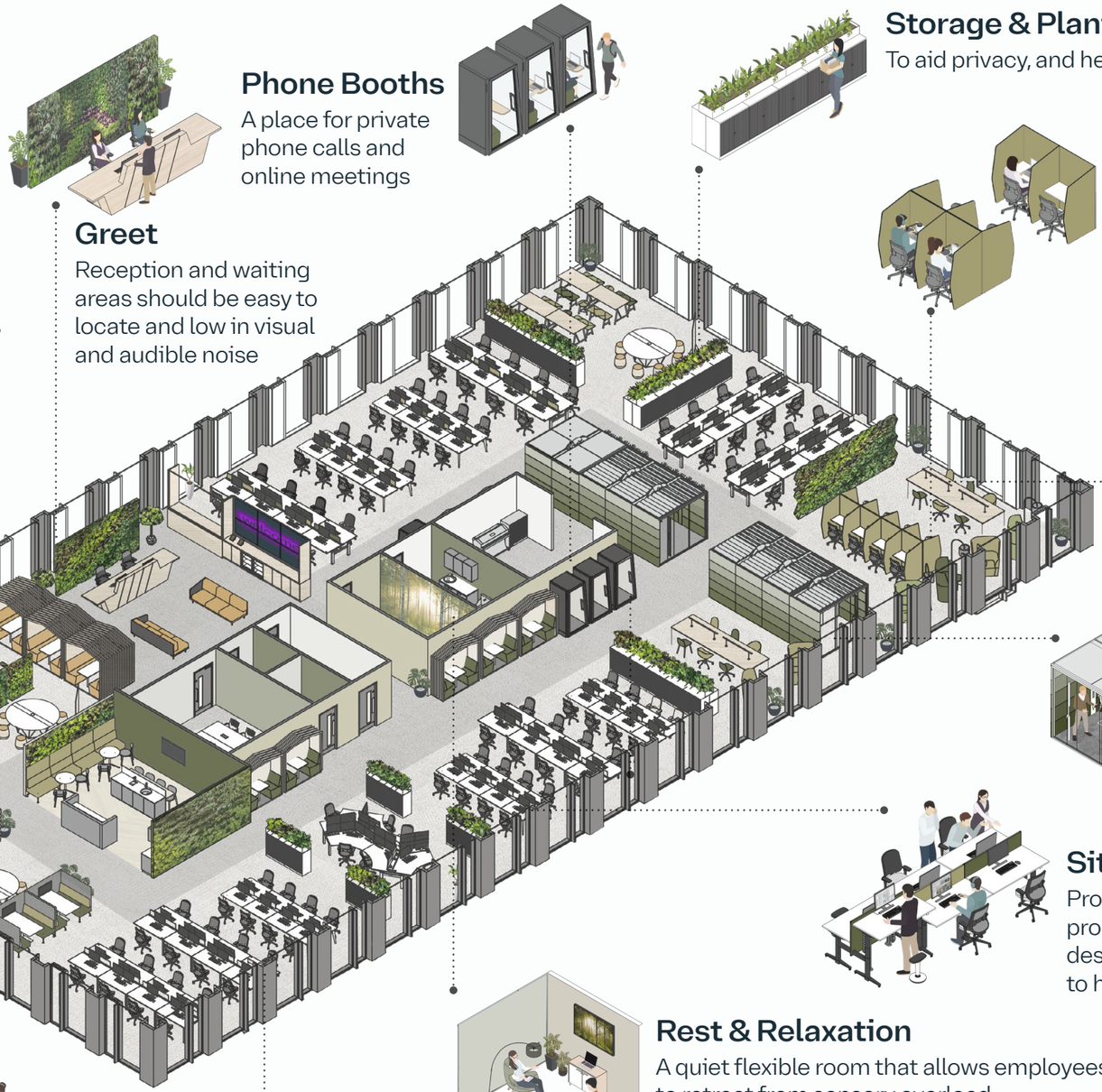
Semi-enclosed niche providing opportunity to move away from open workstation. Can provide opportunities for pause when walking along corridor and large floor plates. Careful consideration should be given for wheelchair users.

Activity & stimuli zoning

Active / Social
Higher Stimuli

Quiet / Focus
Lower Stimuli

The inclusive office



Greet

Reception and waiting areas should be easy to locate and low in visual and audible noise

Phone Booths

A place for private phone calls and online meetings

Storage & Planting

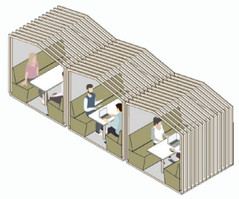
To aid privacy, and help reduce noise

Focus

Booths with acoustic panels, height adjustable tables and lighting

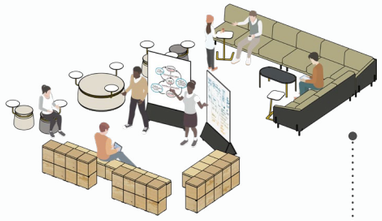
Focus

Touch down tables within focus zones with table top lighting and acoustic partitions



Meet or Retreat

Semi-enclosed booths for collaboration or a place to rest and retreat

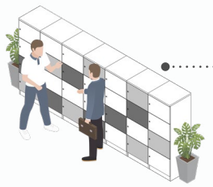


Socialise & Collaborate

Located away from quieter focus zones with active furniture which allows movement

Meet or Retreat

Enclosed acoustic meeting booth or room with adjustable lighting and airflow



Storage & Planting

To aid privacy, and help reduce noise

Sit-Stand Desks

Provide a generous proportion of sit-stand desks and dual monitors to help aid concentration

Rest & Relaxation

A quiet flexible room that allows employees to retreat from sensory overload. Consider adjustable lighting, storage, soft furnishings and pictures of nature

Collaborate

Provide a variety of spaces with varying degrees of stimulation

Workstation

Consider tambour units with planting along walkways to aid privacy and reduce visual distractions

Summary

Category	Recommendation
Acoustics	▪ Position workspaces, especially quiet desk areas in low-traffic areas ▪ Offer quiet rooms and private work pods for intense concentration ▪ Finish each office zone with acoustic dampening materials like baffles, and panels ▪ Where spaces are inherently reverberant, consider using softer materials on floors, walls, and ceilings to reduce noise reflection ▪ Consider acoustic zoning and allow for a gradual transition from quiet to noisy areas ▪ Use dividers and soft furnishings and upholstered high back furniture pieces to block and reduce unwanted noise ▪ Encourage employees to use noise-cancelling headphones if desired, but do not assume that this is always the answer as individuals can get overheated if they use them all the time ▪ Consider an active noise cancelling or sound masking system, but not as a first resort ▪ Use planting strategically to help dampen noise, as the leaves, stems, and branches absorb, deflect, and refract sound
Air Quality & Odour	▪ Regularly service the HVAC to facilitate healthy air quality and circulation to limit any intrusive smells ▪ Limit the use of construction materials and finishes containing toxins or emitting volatile organic compounds (VOCs) and semi-volatile compounds (SVOCs); ▪ Where possible, select carpets that are free of adverse chemicals and opt for those with a low pile ▪ Select low-VOC or water-based adhesive products if used ▪ Introduce plants that help to reduce VOCs, such as bamboo palm, areca palm or snake plants which absorb toxins and release more oxygen into the room ▪ Install louvres and/or openable windows where possible to facilitate purging and ventilation
Lighting	▪ Ensure workspaces aren't lit too brightly ▪ Offer adjustable lighting where possible ▪ Consider providing a combination of fixed and task lights ▪ Ensure lighting does not flicker or hum

Category	Recommendation
Lighting	▪ Avoid concentrated light sources and visibility of strings of LED's ▪ When specifying LEDs make sure that there is a good colour balance and that there is avoidance of the effect of a blue spike in their output ▪ Limit light pollution or undue light spill onto adjacent areas ▪ Let natural light flood select spots in the office ▪ Minimize glare from windows with glare-reducing film, blinds, or curtains ▪ Fast moving or changing light effects should be avoided or introduced with consultation ▪ Be mindful of sharp changes in colour/tone in floor treatment or shadows as they can be misinterpreted as a barrier or obstruction ▪ Be mindful too of patterns created by shadows and cast by lighting through objects and screens
Materials	▪ Contrasting, transitional, colour coding of floor surfaces should be carefully considered in the context of building users and designed accordingly ▪ Whilst doorways are the ideal location for a change in floor material, care should be taken ▪ Transitions should match the tones of both flooring surfaces, to avoid creating the impression of a step or level change ▪ Avoid shiny or visually contrasting transition strips as they can cause confusion for some people ▪ Be cautious of mosaic effect /rotated alternate carpet patterns and asses them carefully for potential visual or vestibular disturbance ▪ Entrance mat system with an intermediate colour, should aid the transition between indoor and outdoor contrasting surfaces, however do not use highly contrasting brush and holders as this is very visually noisy ▪ Avoid large areas of reflective materials and be careful even with small areas ▪ Rough, scratchy textures can be problematic, select furniture that is soft to touch ▪ Natural materials are often more comprehensible, calming and uplifting than synthetic counterpart's ▪ Materials that contain chemicals and VOCs should be avoided

Summary

Category	Recommendation
Movement	▪ Provide active zones that foster movement with rocking chairs, active stools, mobile whiteboards, and space to pace ▪ Invest in ergonomic furniture that supports movement at the desk like footrests, active chairs, and sit-stand desks ▪ Provide opportunities for dual monitors, which can assist with organization and information retention
Patterns, Colour & Biophilla	▪ Minimise sensory overload by avoiding highly repetitive and busy pattens ▪ Common sources of discomfort can be found in the following, tiling with gloss finish and accentuated joints, louvres, slats and battens, perforated sheet' materials, railings, overly contrasting stair nosing and entrance mats ▪ The following should be considered when evaluating visual discomfort: large areas of stripes and geometric patterns with high contrast, equally spaced and sized repeating elements of high luminant or chromatic contrast, patterns in three dimensional forms ▪ Be careful of patterns that resemble motion blur ▪ Ensure patterning along circulation routes do not create a flicker rate within sensitive ranges ▪ Consider reducing tonal contrast between a pattern and its background or use muted colours to reduce the visual noise ▪ Keep the peripheral visual field clear of bold patterns where people are likely to sit for longer periods ▪ Lower visual content in key areas such as communication points and quiet / focus spaces ▪ Combine views to the outside alongside indoor biophilic features where possible ▪ Connect with nature with organic forms and textures ▪ Use natural finishes, materials, and avoid complex, repetitive and bold linear patterns ▪ To promote calm and decrease anxiety use colours that occur in nature, such as browns, greens, and blues. If using reds and yellows use judicially and in muted and more earthy tones ▪ Introduce living plants to assist in reducing anxiety and discomfort, but be mindful not to select plants with strong and distinctive scents such as lavender

Category	Recommendation
Thermal Comfort	▪ Consider heat recovery systems to assist in providing fresh air ▪ Ensure optimal humidity and airflow through the space ▪ Ensure consistent yet programmable heating and cooling 'zones' with an adequate user-friendly interface ▪ Design thermally varied spaces, such as a naturally ventilated atrium or an outdoor patio, so people can choose a location that suits their thermal preference ▪ Control solar gains in perimeter spaces so people beside the windows don't overheat ▪ Improve the performance of the building envelope for even conditioning throughout the space ▪ Consider investing in desktop air purifiers, fans, and heaters for those who may require them ▪ Bring in more plants to clean and freshen the air, help achieve target humidity levels, help reduce stress and increase wellbeing
Variety of Workspace	▪ Enable employees to manage their sensory sensitivities by providing a range and varied type of workspaces ▪ Allow employees the freedom to select these workspaces based on their needs or the task at hand ▪ Provide varying and flexible arrangements for socialising and independent focused work ▪ Create quiet work zones within the office floor plate, away where possible from busy areas ▪ Offer options for working in both semi-enclosed and fully enclosed pods for privacy ▪ Create active zones for collaboration with higher levels of stimulation and flexible furniture ▪ Consider creating a dedicated rest room separate from social and kitchen spaces where people can find relief from stress and sensory overload. Introduce changeable lighting and optional and controllable nature sounds or soothing music

Summary

Category	Recommendation
Visual Distractions	▪ Improve visual privacy and mitigate distracting visual movement by providing some areas with mobile partitions and desktop dividers ▪ Use biophilic design elements such as planting to break up unnecessary visual sight lines ▪ Allow employees to book seats away from doors, windows, displays, printers, and tea bays if preferred ▪ Reduce visual clutter, provide storage space, and promote a clean desk policy, whilst permitting and encouraging appropriate personalisation of space when occupied. ▪ Eliminate or cover devices and equipment that flash
Wayfinding	▪ Each zone or space should be intuitive and easy to navigate with clear, consistent signage ▪ Consider displaying a simple plan of the interior at the entrance to help reduce anxiety, or produce a website friendly digital walkthrough of the building to allow people to do a dry run of their route ▪ Offer wayfinding markers adjacent to doors and entrances to set a sense of place and context ▪ Avoid signs which include multiple different colours as they may overload the senses ▪ Where colour coding is seen as a helpful indicator, designers should also create a symbol ▪ Provide clear alternative routes that allow the option to bypass particularly busy spaces, corridors, and lobbies where possible ▪ Provide heat maps of busy times ▪ Use repeated design features to create a reassuring sense of order and familiarity ▪ Use strong but judicially executed focal points like artwork, colours, feature, and green walls to help employees orient themselves and act as memorable landmarks ▪ Colour coding to zones on a floor and amenities with different types of floor surface to distinguish between circulation routes and destinations can be a helpful aid for some, but remain mindful of creating visual barriers and noise. Consider other means of distinguishing floors too. ▪ Avoid the use of highly contrasting/ alternating and busy patterns for flooring and walls, especially general circulation areas ▪ Use appropriate lighting to help aid navigation and avoid glare

Category	Recommendation
Zoning	▪ Zoning provides choice and potentially helps prevents sensory overload, and can aid wayfinding ▪ Some zones should be more open and potentially more social, while others should be closed and more private ▪ Quiet / focus/library zones should be quieter and limited in stimuli & located away from busy areas ▪ Some and not all active zones can be high-energy, high stimuli and offer hands-on tactile elements but most should be dialled back to enable equitable participation. ▪ Consider varying ceiling heights, within some zones with lower ceiling's in more intimate quiet spaces

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