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Research Essay
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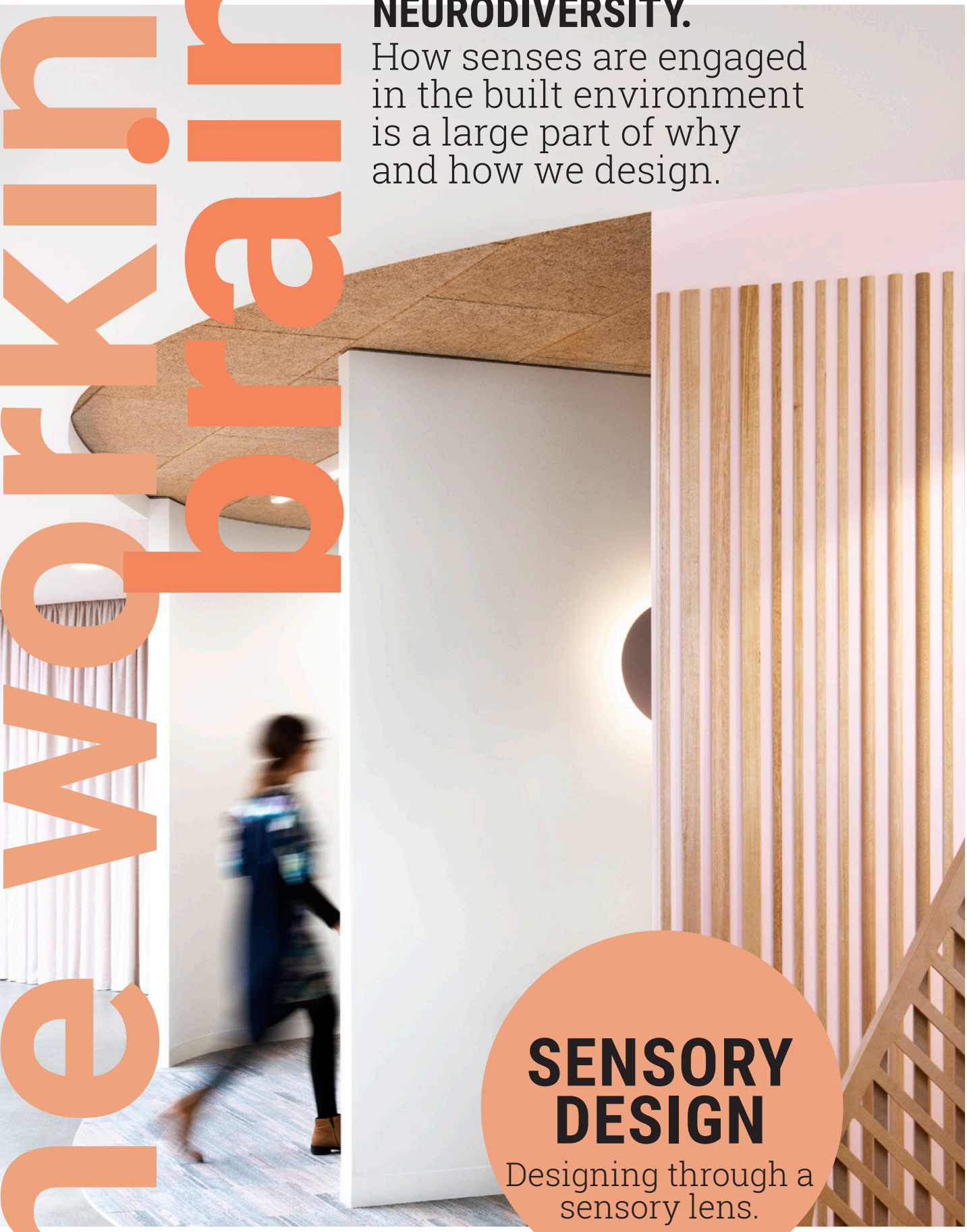
# NEURODIVERSITY.

How senses are engaged in the built environment is a large part of why and how we design.



## SENSORY DESIGN

Designing through a sensory lens.

# HEAR IT.

**I have confidence, that designing spaces in response to human sensory profiles will lead to better learning and working conditions for those with Sensory Processing Disorder (SPD) or unusual sensory processing patterns.**

## 02

**Sonja Duric**
Principal GroupGSA Melbourne

How senses are engaged in the built environment is a large part of why and how we design.

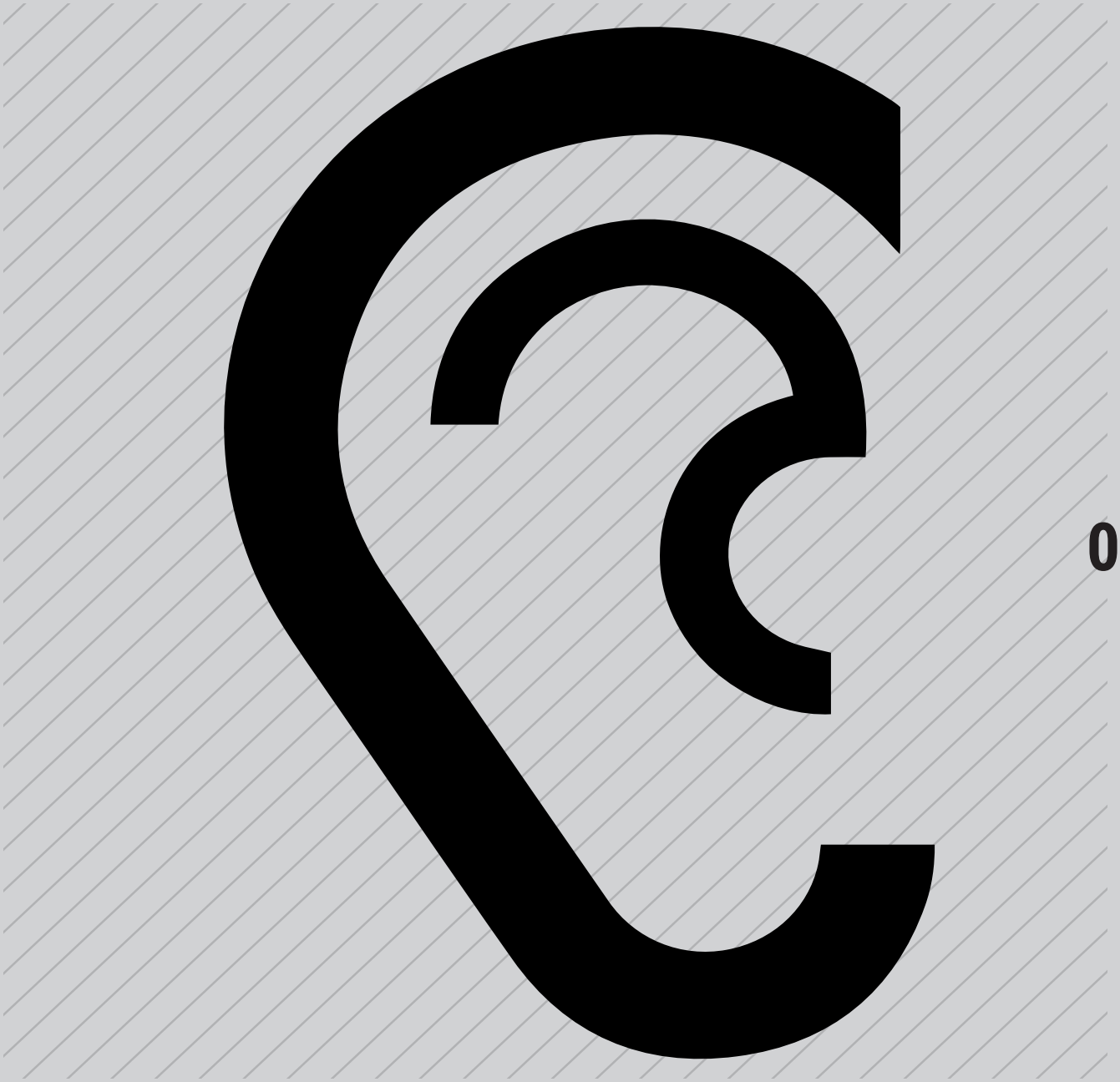
When the author of Living Sensationally, Winnie Dunn, describes people who have unusual sensory processing patterns as living a more intense version of life, I question what impact our built environment has on our bodies, senses and therefore our comfort and quality of life, particularly in high input and output environments like workplaces and education settings.

I have confidence, that designing spaces in response to human sensory profiles will lead to better learning and working conditions for those with Sensory Processing Disorder (SPD) or unusual sensory processing patterns.

As a result of over 20 years of practical experience designing workplaces and built environments, I have seen many shifts in working environments. Often these shifts are driven by immediate economic drivers. There are exceptions.

About two decades ago, society started to measure the impact of the built environment on our natural surroundings. We realised if we did not start making positive sustainable design changes, then we would continue to adversely affect our planet.

In more recent history and through the creation of the WELL building rating,



03

## * NEURODIVERSITY

**18% of our population is neurodivergent yet as design professionals we design for the neurotypical cohort, therefore, missing out on talent, contributing to people's anxiety, depression and exclusion. As designers we have the desire to understand this in more detail and begin designing for a broader group of people.**

the importance of well-being has become a focus within the workplace sector and further afield. Built environments are now being designed in consideration of people's well-being (e.g. encouraging good nutrition, movement, access to light, access to sleep, amongst many other things).

The "GIG" and "Sharing" economies are shaping change too, resulting in environments which encourage creativity and agility. Many corporate workplaces have adopted an agile or ABW (activity-based working) environment within their workplace. These kinds of environments are based on either an activity or a "choose your own adventure" model of selecting a setting or chair or desk. The symbol of this act of choice is that of worker empowerment.

The ABW or agile model is a logical progression from the way our schools are currently being designed particularly in Victoria, Australia. They are based on an open plan, multiple setting and interconnected classroom archetype. The didactic model which includes an enclosed classroom with lines of school desks and an educator teaching from the front is seldom in the vocabulary of the state school design standard. Similarly, rigid and static work environments are becoming less common. Both symbolise the authoritarian working and learning style as a thing of the past.

The agile or ABW model is also a natural progression from tertiary education settings where students move from space to space depending on their lecture or subject.

Technology further enables this movement meaning in education

## About 5%-16% of the population has some form of Sensory Prococessing Disorder.

many lectures are now held online. Similarly, within the workplace, it is now possible to work from other locations beyond the workplace. With all these shifts taking place, I started to think about unusual sensory processing patterns and how people's sensory profiles could shape comfortable environments for people who do not fit the norm. Furthermore, what design model best enables a more inclusive space resulting in success for a greater proportion of the community?

To be able to answer these questions, understanding sensory processing patterns is imperative.

Our senses include:

- Sight
- Smell
- Taste
- Hearing
- Touch
- Vestibular
- Proprioception

About 5%-16% of the population has some form of Sensory Processing Disorder (SPD Australia n.d. and STAR Institute for Sensory Processing Disorder n.d.).

Sensory Processing Disorder (SPD) may affect one sense or it may affect multiple senses.

## SIGHT

**A sense of vision. How visual stimuli affect the eye and therefore brain is the result of the sense of sight or vision.**

## SMELL

**A sense of smell. How odour stimuli affect the nose and therefore the brain is the result of the sense of smell or olfaction.**

## TASTE

**A sense of taste. How flavour stimuli affect the mouth and therefore the brain is the result of the sense of taste or gustation.**

## HEARING

**A sense of hearing. How sound stimuli affect the ears and therefore the brain is the result of the sense of hearing or audition.**

## TOUCH

**A sense of touch. How textures and materials affect the skin and therefore the brain is the result of the sense of touch or somatosensory.**

## VESTIBULAR

**A sense of movement. How the body; in relation to gravity, movement and balance, affects the fluid in the inner ear and therefore the brain is the result of the vestibular system.**

## PROPRIOCEPTION

**A sense of body awareness. How the body relative to the position of neighbouring body parts and the strength to move them affect coordination and the brain is the result of the proprioception.**

People can be over-responsive (hypersensitive) or under-responsive (hyposensitive) to the things they have difficulties with. According to Dunn (2008, p.32), each of these two categories has two sub-categories; hypersensitive = avoiders and sensors, hyposensitive = seekers and bystanders.

We regulate our response to stimulation or input either passively or actively. An avoider and seeker actively regulate while a bystander and sensor passively regulate. An example of active regulation includes humming to block out noise. Passive regulation means that sensory input happens followed by a reaction. In the case of a sensor, an example of passive regulation includes feeling “bothered” by the sounds. In the case of a bystander their passive regulation means they may be oblivious to sounds.

Some people are their best selves when they are overstimulated with colour, complexity, art, noise etc. For example, some bystanders need this to stay alert. They are more productive in this environment. Others require calm, order and neutrality. These may be the avoiders and sensors.

The above is informing us that as designers we should consider at least two modes within our built environment: (1) a high stimulation mode and (2) a low stimulation mode. There are other variables within each of these modes which may be considered. They each come with SENSORY DESIGN INTERVENTIONS (SDIs).

# SENSORY DESIGN INTERVENTIONS

06

01

## SDIs for Sight or Vision

Bystanders and Seekers may positively be impacted by:

- Colour
- Complexity
- Art
- Pattern
- An abundance of shape
- Bold finishes and materials
- Views
- Windows and glazing connecting views
- Bright (but warm) lighting
- Interesting navigation and pathways

Sensors and Avoiders may positively be impacted by:

- Order
- Neutral palette
- No bold colour
- Limited quantity of colour
- Natural materials
- Limited quantity of materials
- Simple art
- Controlled windows and glazing connecting views
- Blinds or shutters on windows and glazing
- Lower lighting levels
- Warmer colour temperature in lights
- Simple navigation and pathways


02


03

**01**

**Bold art and graphics are suited to a sensory seeker or bystander.**

**02**

**Bold colour, finishes and materials are suited to a sensory seeker or bystander.**

**03**

**Neutral materials, limited texture and shielded external views are suited to a sensory avoider or sensor.**

# 08

01

## SDIs for Smell or Olfaction

Bystanders and Seekers may positively be impacted by:

- Strongly scented planting (e.g. herb gardens)
- Strongly scented (natural) cleaning products (e.g. eucalyptus, lavender, peppermint)
- Cooking smells i.e. communal kitchens near social spaces or study spaces / work areas
- Scented materials
- Devices emitting aromas

Sensors and Avoiders may positively be impacted by:

- E-water cleaning products (unscented)
- Excellent ventilation especially in cooking or eating areas
- Segregated cooking areas (fully enclosed and ventilated)
- Locating spaces with strong smells away from study spaces / work areas
- Filtering strong external environment smells
- Very low or nil VOC products, materials and finishes



**01**

**Scented planting pathways are suited to a sensory seeker or bystander and support navigation for the visually impaired.**

**02**

**Scented planting zones are suited to a sensory seeker or bystander.**

**03**

**Contained cooking areas are suited to a sensory avoider or sensor.**

01

## SDIs for Hearing or Audition

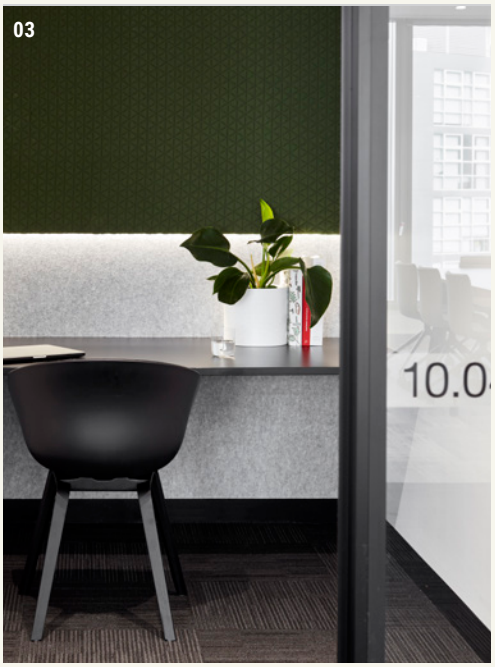
Bystanders and Seekers may positively be impacted by:

- Music
- Sound systems (e.g. mirroring sounds from nature)
- Human activity
- Being near pathways
- Being near active areas
- Being near openable windows
- Wearing headphones

Sensors and Avoiders may positively be impacted by:

- Retreat spaces
- Quiet zones
- Focus rooms
- Smaller concentrative spaces
- Wearing headphones to cancel noise
- Being away from active areas
- Being away from active pathways
- Being away from external noise (e.g. away from open windows)


02




**01**

**Quiet nooks are suited to a sensory avoider or sensor.**

**02**

**Active pathways are suited to a sensory seeker or bystander.**

**03**

**Quiet nooks are suited to a sensory avoider or sensor.**

01

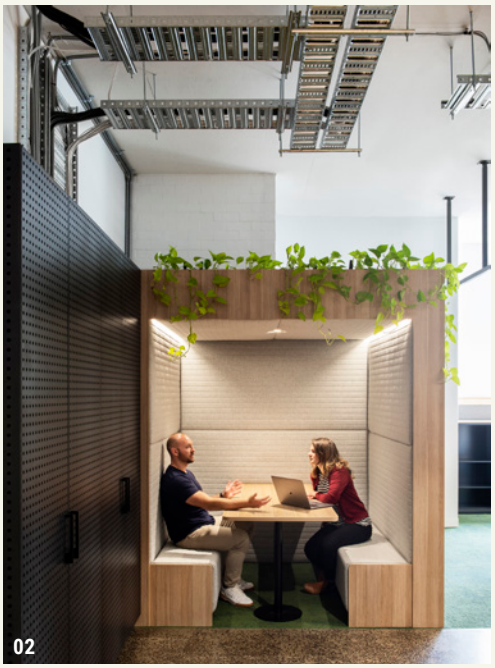
## SDIs for Touch or Somatosensory

Bystanders and Seekers may positively be impacted by:

- Upholstery with a variety of textures
- Being near other people (e.g. bench seating)
- Walking barefoot (e.g. creating a tactile zone within the design which enables barefoot contact with uneven surfaces such as grass or pebbles)

Sensors and Avoiders may positively be impacted by:

- Smooth materials
- Comfortable and generous furniture (not body hugging)
- Being away from other people (adequate space between chairs and desking in work, learning and social settings)
- Furniture clusters enabling alone areas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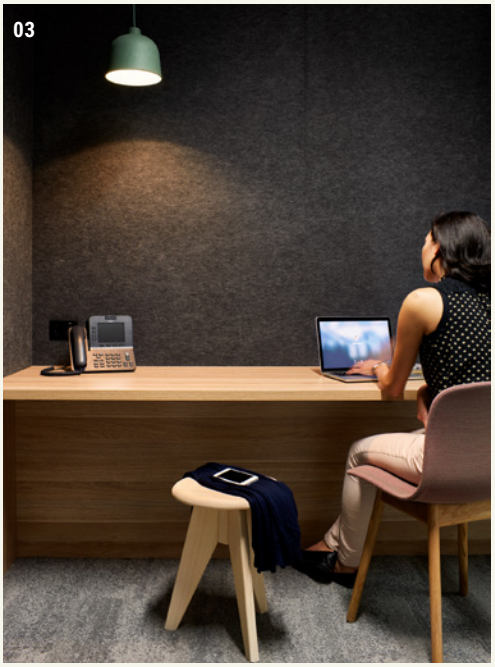
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**01**

**Bench seating enabling closeness is suited to a sensory seeker or bystander.**

**02**

**Textured upholstery and being close to others are suited to sensory seeker or bystander.**

**03**

**Having alone time is suited to a sensory avoider or sensor.**

**Often forgotten or unknown senses include the Vestibular and Proprioceptive Systems. These senses are crucial for the way our body moves and behaves in space.**



## Vestibular

The vestibular system is the sense of “movement”. It lets us know if we are moving and how fast we are going and in which direction we are headed.

It affects almost everything we do. Balance, coordination, fine motor skills, and even self-regulation all rely on the vestibular system. When there is a problem with vestibular processing, the body doesn’t know how to move and react to the environment. Often people who have this obstacle are uncomfortable in their surroundings. They may either have a meltdown or they may zone out as a reaction. Both these reactions can have an impact on our ability to function effectively.  A considered built environment may play a positive role in improving comfort.

## Proprioceptive

The proprioceptive system is the sense of “body awareness”. It is the sensation of joint motion and acceleration which in turn provides feedback for motor control and posture. If the proprioceptive system isn’t interpreting input correctly and responding appropriately, the person may appear as being clumsy or rough. The person may use another sense, for example vision, to compensate for the lost feedback from the proprioceptive system. Deep pressure in this situation can provide a calming effect improving self-regulation and reducing anxiety.

## SDIs for Vestibular and Proprioceptive Systems

All sensory profiles within the vestibular and proprioceptive systems may positively be impacted by:

- Swinging (e.g. sitting on chairs that move or rock)
- Climbing (e.g. using stairs to travel between floors)
- Jumping (e.g. exercising in a discrete location e.g. in an unused room or incorporating a sensory room with equipment such as a small trampoline, balance beams, stretch bars and rings)
- Hanging (e.g. incorporating stretch bars or high-level bars within the design or in a sensory room)
- Balancing (e.g. incorporating a balance course within the design e.g. via linework in a floor pattern or graphic)
- Walking barefoot (e.g. creating a tactile zone within the design which enables barefoot contact with uneven surfaces such as grass or pebbles)
- Assisting with improved memory (e.g. using landmarks or key design features for orientation and wayfinding)
- Standing and sitting (e.g. standing desks or higher benches to assist with varying between sitting and standing)



**01**

**Moving is suitable to all sensory profiles and may assist with regulation and focus.**

**02**

**Climbing is suitable to all sensory profiles and may assist with regulation and focus.**

The built environment may adversely affect someone with SPD. For example: the artificial lighting or natural light may be too bright for their vision or the traffic noise outside the building may be too distracting because they have hypersensitive hearing. Headphones may assist in removing the external noise, but they may also be hypersensitive to touch and therefore, headphones may cause physical discomfort. The range to which sensitivities are affected is vast.

Designing spaces that have multiple modes for intensity (high and low intensity) may be a large step towards assisting with comfort for a broader cohort.

Other simple adjustments within the workplace may contribute to this too, for example rocking or moving chairs.

Being empowered to have choice as to where to sit, work or collaborate is key to managing comfort for diverse users within any built environment.

Therefore, in the instance of a workplace, the ABW or agile model which includes a range of spaces with a range of intensities fitting different sensory profiles is a sound approach.

The earlier example of a person with hypersensitivity to light, sound and touch may result in their choosing a spot with lower lux levels at a warmer light temperature, in an area designated as the quiet zone possibly away from busy views or busy walls.

## Having choice is key to managing comfort for diverse users.

In the instance of the current Victorian state schooling model, there has been a shift of matching spaces with those who are hyposensitive. Spaces are often colourful, complex, noisy, connected and exciting. More consideration needs to be given to the mode that fits the hypersensitive sensory profile.

Therefore, since students are relatively agile during independent or group tasks, learning spaces may consider offering areas that fit the descriptors above for SENSORY DESIGN INTERVENTIONS particularly for hypersensitivity. Examples include rocking chairs, environments which are quieter, neutral in colour, pattern and texture and away from external views. This applies to higher learning institutions. Other ideas may include spaces that support heavy work (inside and outside the classroom). Monkey bars are not passé in context of having a calming effect for those with proprioceptive and vestibular sensitivities.

In conclusion, I have confidence designing through a sensory lens will result in improved comfort, inclusion and success for the larger population. Key to this is providing the user with choice and control over their space, as well as a diversity of settings (collaborative and individual) with a minimum of two sensory modes (high intensity and low intensity).

# IMPRINT

The author of this article, Sonja Duric, is a part of a group of designers researching Neurodiversity and Mental Health in the built environment. You can follow their progress at:
theworkingbrain.net

Due to a lack of data on designing for the neurodivergent person, the research team will test SENSORY DESIGN INTERVENTIONS across a range of design projects. In context of Sensory Processing Disorder, the team will establish people's sensory profiles (using an Occupational Therapist Measuring Tool) and then research the comfort factors of various built environments which have been designed with SENSORY DESIGN INTERVENTIONS. The results of this research will be available in late 2020.

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