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Sense and Sensibility in Universal Design for Neuroinclusion

Dr Cathy Dalton, Architect, Researcher

"The language around neurodiversity is broken.

Pulled three ways. None of them honest.

Over-medicalised:
patient, disorder, deficit, co-morbidity.

Over-sensationalised:
superpower, gift, talent, supremacy.

Over-politicised:
over-diagnosis, faking it, trendy, playing the system."[1]

The above is a recent LinkedIn post from Ben Branson, neurodivergent advocate and entrepreneur. Design for Neurodiversity, perhaps better described as "Design for Neuroinclusion" is in the welcome process of going "mainstream". It is an important moment for architects and designers to to pause and

[1] Branson, B. 2026, June The language around neurodiversity is broken.Pulled three ways. None of them honest.Over-medicalised:patient, disorder, deficit, co-morbidity.[post] LinkedIn. https://www.linkedin.com/posts/benbranson_the-language-around-neurodiversity-is-broken-share-7469399152351932416-zQqd/

reflect on what "neurodiversity" means, and exactly who and what we are designing for.The idea first emerged from the Neurodiversity Movement of the 1990s, itself a product of the Autism Rights movement. The "neurodiversity paradigm", as proposed by the Australian academic Judy Singer holds that there is no single "correct" type of human brain, and that neurodiversity is an essential form of human diversity. Singer argues that "*biodiversity is essential to ecosystem stability, so neurodiversity may be essential for cultural stability",*and that this perspective can be used "*to advance the causes of people with disabilities"*[2]*.* That last is important to remember in midst the current and often furious debate about what neurodiversity means, who is and who is not neurodivergent, and whether or how, when it comes down to design in the built environment, the distinction matters. The neurodiversity paradigm differs substantially from traditional medical models of disability, which tend to regard any significant deviation from a normative standard as pathological, and seek to "cure" or "fix" it. While the term is most commonly used in relation to people with Autism Spectrum Conditions, it can be extended to include other users/consumers of design, such as people with ADHD, with acquired neurodivergence e.g. through brain injury, also people with dementia, and with intellectual disability."Autism spectrum conditions" include ADHD, dyslexia, dyspraxia, and dysgraphia. About 50% of autistic people have an intellectual disability, but even a decade ago the assumption was that a majority of autistic people did. Landmark reports, such as those by the INCLENTrust, estimate

[2] Singer J. (1999)" Why can't you be normal for once in your life?" From a problem with no name to the emergence of a new category of difference, in Corker M, French S (eds.). Disability Discourse. Buckingham, UK: Open University Press, 59–67.

that nearly 1 in 8 children in India (aged 2 to 9) live with a neurodevelopmental condition.[3]

People born with sensory disabilities are also effectively neurodivergent, by virtue of atypical early brain development. Recent research indicates that rates of autism are much higher in people born blind or visually-impaired: At least one-third (33% to 38%) of blind children meet the diagnostic criteria for autism spectrum disorder, rising to 54-75% for children born completely blind. [4] Some of this is due to behavioural overlap. For the designer, tackling the challenge from the basis of needs and affordances for these users often amounts to the same task as designing well for other neurodivergent users.

Before the DSM-5,[5] published in 2013, the categorisations in the manual meant that people diagnosed with autism could not also be diagnosed with ADHD, and vice versa. Since dual diagnosis became possible, it has become apparent that there isa considerable overlap between the two conditions. The dual diagnosis is referred to informally as "AuDHD"; but this is not a clinical term. At the same time the new diagnostic criteria put people with what used be referred to as "Asperger syndrome"- with no intellectual disability, in the same diagnostic "box" as box as people with "classic" autism, which has also created enormous controversy. Recent and often

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[3] ***Silberberg, D., Arora, N., Bhutani, V., Durkin, M., Gulati, S. (2013) Neuro-Developmental Disorders in India – An INCLEN Study (P04.229) https:// www.neurology.org/doi/10.1212/WNL.80.7_supplement.P04.229***

[4] ***de Verdier K, Fernell E, Ek U. Blindness and Autism: Parents' Perspectives on Diagnostic Challenges, Support Needs and Support Provision. J Autism Dev Disord. 2020***

[5] American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

lively online debate has emphasised a need for more nuanced terminology when it comes to autism, or rather "autisms". There is now research which suggests that there is a genetic basis for this too.[6] The point is controversial, as there is a persistent conflict between clinical and social constructs of autism and ADHD . However attractive and inclusive the "neurodiversity paradigm" might seem, it runs the risk of sidelining people who are severely disabled by autism and related conditions, at the same time neglecting the needs of "high-functioning" people who seem to "get by", but suffer from severe anxiety and other mental health conditions. Designers, however, are not here to diagnose, but to try to address the needs of their users, taking Universal Design as a starting point, with an intention to improve the quality of built environment. We need to equip ourselves to design buildings and places that accommodate the needs of neurodivergent users as far as possible, as well as designing dedicated specialist settings like schools and supported housing. Designing for the senses allows is how we might achieve this, and to inform that process we need to look more closely at the overlaps and the occasional gaps between designing for the different groups who have issues around sensory processing, and sensory and physical disability.

Sensory processing issues are common to both autism and ADHD, and are particularly important when it comes to designing the built environment to "fit" its users. At the same time, addressing sensory needs though design optimises usability for the greatest number of people. In total, it is estimated that in the region of 15-20% of

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[6] Litman, A., Sauerwald, N., Green Snyder, L. *et al.* Decomposition of phenotypic heterogeneity in autism reveals underlying genetic programs. *Nat Genet* 57, 1611–1619 (2025). https://doi.org/10.1038/s41588-025-02224-z

people are "neurodivergent", in clinical terms: more if people with dementia and intellectual disability are included. [7] Autistic people are more likely to develop dementia, as are people with Down syndrome. Neurodevelopmental and neurodegenerative conditions share fundamental disease biology, perhaps explaining the commonalities found in designing for both[8].

Dementia is associated with ageing. New evidence indicates that it is more prevalent in women, not only because they typically outlive men, but because of inflammation post-menopause. Even "normal" ageing results in a deterioration in sensory perception, so that neuroinclusive design can also be considered as "age-friendly". In total, we are looking at around 1 in 4 of our end-users, far too large a cohort to be ignored. This is not design for some "other". It is also what Roger Coleman termed "Designing for our Future Selves", and it would be wise to remember that, even in countries with different demographic profiles to the West's ageing demographic, it is simply a matter of later, if not sooner.

While neurodiversity may be understood as a different way of experiencing the world, this interpretation should not be used to diminish the severity of disability experienced by many neurodivergent people. While nearly half of all creatives identify as neurodivergent (e.g., ADHD, autism, dyslexia), they are clearly not all disabled. Some forms of neurodivergence can confer an advantage in specific careers, where non-linear thinking, hyperfocus and problem-solving are essential skills. Many autistic people do

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[7] ***Dalton, C. (2023), Nov 1 Design for Neurodiversity, at STU Bratislava.***

[8] ***Dalton C. (2016). Interaction Design in the Built Environment: Designing for the 'Universal User'. Studies in health technology and informatics, 229, 314–323.***

have successful careers, especially in IT, while other forms of neurodivergence are common in some professions, including in architecture, engineering and design, but typically, autistic people and people with ADHD have significantly lower rates of employment, and experience a "pay gap". Autistic people also have a substantially higher risk of suicide, and co-occurring mental health issues.

Designing for Neuroinclusion, as an essential aspect of Universal Design may offer a route though the controversy. There is no firm scientific boundary between "neurodivergence" and "neurotypicality". Regardless of that we must include, through design, people who are currently still marginalised from physical participation and visibility in society, and in so doing, make better places for better people, who are better in the sense of experiencing greater well-being. In the visionary 1993 words of Paul Hogan, founder of the (Irish) Institute of Design and Disability, repeated in the EIDD's 2004 Stockholm Declaration, "Good design enables, bad design disables".[9] Design for All, Universal Design, and Inclusive Design are comparable concepts, with slightly differing disciplinary and cultural origins. Universal Design, defined by Ron Mace and his colleagues at The Center for Universal Design[10] is rooted in architecture, product design, engineering and environmental design. It makes some sense in the context of a design discipline whose outputs are often very large in scale, complex, costly, and have a high degree of permanence, to design universally from the outset,

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[9] ***Hogan, P., 2004, May 9. The EIDD Stockholm Declaration 2004.EIDD. https://dfaeurope.eu/what-is-dfa/dfa-documents/the-eidd-stockholm-declaration-2004/T***

[10] ***Connell, B.R., Jones, M., Mace, R., Mueller J, Mullick, A., Ostroff, E., Sanford, J.,E Steinfeld, E., Story, M.,& Vanderheiden, G. (1997) The Principles of Universal Design. North Carolina State University, The Center for Universal Design.***

often in the context of an evolving and changing regulatory framework, but even that aspiration must be qualified by the context of architectural practice. Care must be taken in uncritically applying principles derived from one discipline in another, and in not reducing the discourse to mere sloganeering.

At the same time, it should be acknowledged that many architects from many cultures have over time designed and theorised about architecture from a multisensory perspective, from the Mughal architects of the Amber Palace, to Richard Neutra in his seminal work, *Survival Through Design*(1954). The recent upswell in interest in designing for neuroinclusion is in many ways but the latest turn of the wheel, rediscovering knowledge which had been lost or dismissed as anecdotal, or being evidenced now through advances in scientific research, including in the new interdisciplinary field of "neuroarchitecture".

Academic approaches to designing for disabled users, including neurodivergent users, have tended to splinter and differentiate according to disability. This is often not constructive in terms of clearly informing professional design practice and education, especially in relation to designing buildings and environments in the public and semi-public domains, where one size must of necessity fit all. The quality of design in such environments is critical to the visibility, societal participation and wellbeing of neurodivergent users. While personal and dedicated environments (e.g. in Special Needs Education) allow greater opportunities for specialist design, we can apply the knowledge acquired in those contexts to other architectural settings. Often, ostensibly "specialist" design interventions, for what are termed "edge cases" in interaction

design and tech, prove to be of benefit to a much broader cohort. This thinking is at the core of Universal/ Inclusive Design approaches. We do need to take care not to extrapolate from unreliable research, or uncritically from built precedent. The former criticism applies in particular to use of colour in environments for neurodivergent users. The evidence base is currently minimal, but has been used, uncritically, as the basis for general design recommendations. A recent report commissioned by Crown paints (UK) indicates that there is a substantial knowledge gap in the design professions around design for neurodiversity. "*While eight in ten (78%) architects and specifiers see a current knowledge gap in the interior design community, this is not a criticism but a call to action – especially as 79% of architects and specifiers recognise the same knowledge gap exists within their own practices. The findings point not to shortcomings, but to a clear invitation for learning, collaboration and leadership"* [11]. If one accepts that good architectural design has the power to change outcomes for users, then how do we proceed?

A closer examination of design theory, principles and built exemplars for different neurodivergent groups reveals a high degree of overlap in terms of design features; there is further commonality with accepted good practice in Universal Design for sensory and physical disability. This is important to remember when confronted with a constant and bewildering array of articles, opinions and and research of varying quality. The intention of this article and of related lectures and future publications in to "make sense" of it all,

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[11]Designing for Neurodiversity. (n.d.). Crown Paints. Retrieved June 17, 2026, from https://professional.crownpaints.com/designing-for-neurodiversity/

so that the information filtered out in the process is of practical benefit to professional designers, to architects, and in design education. The contemporary educational context, however, is that few schools of architecture and design even teach Universal Design at undergraduate level, where it is arguably more appropriately positioned as an essential skill, rather than at postgraduate level. For many of us in the field of Universal Design, understanding how to implement Universal Design, including for neuroinclusion, is a fundamental and essential part of the architect's skillset. No more than Universal Design in general, neuroinclusive design should not be bolted on as an afterthought. If we fail to even attempt to address the needs of one quarter of our end-users, are we even producing good quality designs?

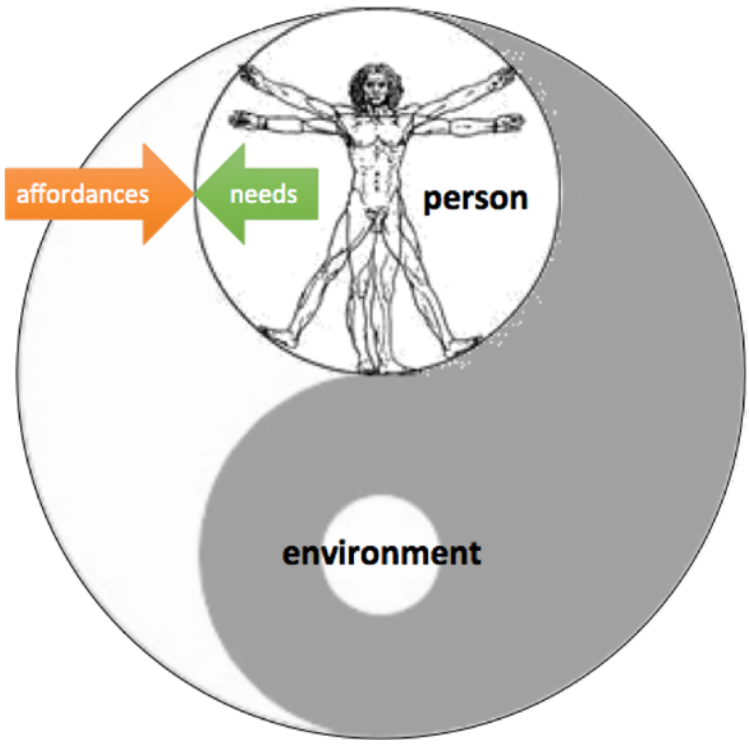

Fig. 1. Congruence/ Environmental fit

Interactionist approaches

One strength of the neurodiversity paradigm is that it is an *interactionist* model, rather than either a medical or clinical model, which are effectively polarised positions. The premise is that the outcome for the end-user is an product of that individual's personal characteristics in constant interaction with their environment. That relationship is dynamic, and evolves over time, an important consideration when it comes to place-making. Inclusion is not only about first encounters, and negotiating the unfamiliar. Individual people vary hugely not only in terms of their individual physical ability, but in terms of sensory perception and cognition. This relates well to principles of congruence and environmental fit in psychology. *(Fig. 1)*. Either the person adjusts to fit their environment, or the environment must be capable of some sort of adjustment to differing individual and collective needs. In the case of users with extreme sensory sensitivity, trial of a nub of neurodivergent conditions, lack of "fit" can lead to extreme reactions such as meltdown, or of avoidance, which is rather less easy to detect. But how to achieve this in a design discipline where the end-product has a high degree of permanence, costs a lot of money, and is made in general of "hard stuff": concrete, steel, stone, timber, ceramic? It's not productive to criticise architecture by self-righteously declaiming that "one size fits one": In the built environment, one size must "fit" many people, with limited exceptions. It is not a pair of trousers, available to buy in different sizes, nor yet a phone app, constantly upgradable. It should also be borne in mind the the standardised sizes for many building elements have been derived over centuries from human measurements, and that has also led to those standards changing

over time. Architecture is not so disconnected from the human scale. The knowledge with which to design well acquiring that knowledge arrives by many routes, including study, practice, knowledge of ergonomics, human perception, personal experience, and "participatory design" which while it is currently popular, has significant drawbacks, and in some cases may be essentially performative. It is far from the *only* means of researching, or acquiring knowledge, and has significant inherent limitations, including being based a very small number of participants, researcher bias, the possibility of manipulating the process toward a desired outcome.

This article aims to focus on the background to designing for neurodivergent users, rather than than on the detail of design interventions.

Sensory processing

90-95% of autistic people have atypical sensory processing, which can result in hyper- or hypo-sensitivity, and sometimes in sensory fluctuation. People with sensory processing issues have trouble organising sensory information. This affects sensory perception. Sensory information can be misinterpreted by the brain, giving rise high sensory sensitivity, or occasionally hyposensitivity to sensory stimulus.There is currently a growing awareness of the fact that women typically have greater sensory sensitivity than men across a number of domains, including higher sensitivity to noise, and significant difference sin thermal perception. Accepted standards may disadvantage them in certain contexts, such as in workplace, where there is no little or no control over personal sensory

environment. The advantage may lie in additional capacity for insight and empathy in women designers.

Sensory sensitivity appears to be the greatest challenge in designing for neuroinclusion in the built environment; while hyposensitivity is also an issue, it is easier to add in sensory stimulus than it is to remove unwanted built-in overstimulation. Sensory sensitivity is also common in ADHD, while sensory-perceptual issues are also an issue in dementia, also contributing to increased stress. Sensory processing issues can include sensory fluctuation, where the intensity of a sensory stimulus can appear to change in terms of individual perception, even where the external stimulus doesn't vary. As a migraineur, I have some personal familiarity with this, during the prodromal phase. Sudden change in sensory stimulus also presents a particular challenge to autistic users: e.g. going from a dimly-lit space into a very bright space, from a quiet space to a noisy, crowded one. Stress appears to be a factor: the more stressed someone is, the more intrusive a sensory stimulus can appear, which in its turn, causes further stress. This applies to most building occupants, but for someone who is neurodivergent, it can lead to overwhelm or even meltdown. Stressors are by no means all environmental: rather, there is an interplay between sensory, cognitive and social stressors.

The "nightmare scenario" for many people with sensory sensitivities is to find oneself in in a large-scale, unfamiliar and crowded public place, where there is too much sensory stimulus: noise, glare, and activity, coupled with insufficient "legibility", and where overstimulus is unavoidable; i.e. where there are no alternatives in terms of negotiating that space, regardless of how essential it is to

do so. Recent devices like noise-cancelling headphones can help, but they come with the built-in drawback that, with exceptions, they also make speech inaudible, and can impact on communication and socialisation if use inappropriately, for example, when used longterm in school settings. The starting-place for ameliorating overstimulus in that scenario is in the design of the built environment: compliance with standards for acoustics in classrooms, careful selection of finishes, adequate space between desks, flexibility in use, quiet spaces. But that is another day's work.

Design for sensory processing issues, and in particular for sensory sensitivity is key to designing successfully for neuroinclusion. It is easier to add in additional stimulus when required, rather than to remove an existing "built-in" stimulus that is too intense. While some advocates for inclusion are wont to proclaim that accessibility should be built in form the outset, this ignores the very nature and vast scale of the built environment, where change necessity happens incrementally and in different geographical locations. Retrofit is a very present reality, and has become more so as the impetus to sustainably re-use of older and unused buildings grows. EU policy aspires to "no net land take"[12] by 2050, and that will inevitably drive the re-use and adaptation of buildings and the public realm on a large scale. Retrofit should not just be about thermal efficiency: in the current international demographic context, it offers a once off opportunity to upgrade at the same time for accessibility, and if organised systematically, to retrofit accessibility on a large scale.

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[12] ***European Commission: Directorate-General for Environment & University of the West of England (UWE). Science Communication Unit. [Directorate-General for Environment, University of the West of England (UWE). Science Communication Unit]. (2016). No net land take by 2050?. Publications Office of the European Union.*** *https://data.europa.eu/doi/10.2779/537195*.

Some countries have taken that opportunity; many others including Ireland, have not, to date.

In commercial practice in architecture and interior design, regular retrofit is the norm for workplaces, and in. The hospitality and retail sectors. This offers significant opportunities for designers and their clients to "build in" Universal and Inclusive Design though retrofit, particularly in relation to designing for neuroinclusion, which is contingent on creating a comfortable and supportive sensory environment, which in many cases can be significantly improved by upgrading the specification of finishes.

All buildings are multisensory, in that we perceive them through all of our senses, all of the time, unless we have a sensory impairment. If designers omit to design buildings taking this into account, people with sensory disabilities and sensory processing issues will be the most immediately and severely affected. If we take care in how we design for the senses, all users benefit, firstly from the very basic perspective of usability, and if we design well, with benefits to wellbeing, productivity, and enjoyment, satisfying the old Vitruvian principle of Delight.

The Seven Senses

Traditionally, we were considered to have five principal senses: sight, hearing, touch, taste and smell. There is now evidence of the existence of many other senses. In design for neuroinclusion, two are of particular significance: *proprioception* and the *vestibular sense.* The sense referred to as *interoception* is also an important concept in terms of understanding autistic end-users, , though it is less easy to address directly through design. Designing for neuroinclusion essentially involves designing for the senses.

The *vestibular sense* involves balance and coordination.The vestibular system interprets information in relation to gravity, movementand balance. *Proprioception* refers to the body's ability both to sense where our body parts are, in relationto the rest of our body, and in space, including in motion. It is an automatic process which is impaired in many neurodivergent users. It affects coordination, and our perceived spatial relationshipsto other people using the same space (proxemics). These two senses act to manage how we move through space. *Dyspraxia* is a sensory-based motor disorder associated with autism, involving the proprioceptive and tactile senses. It can present as clumsiness, but also as difficulty planning how to carry out a (physical) task, untidiness, or difficulty in understanding personal and social space. It is not an intellectual disability. Problems with proprioception and vestibular issues can make it difficult for people to navigate the physical environment, especially busy or crowded areas. They are more likely to trip or fall, or bump into other people. This can affect people's social confidence, and lead to their avoiding environments which are likely to cause them the greatest problems. Issues with proprioception and the vestibular sense can can also arise from

injury or infection, .eg. COVID-19 has resulted vertigo for many people, together with other sensory processing issues, including anosmia and "COVID eyes"(photophobia), as well as an increase in neurological disorders. [13]Design principles for people with impaired mobility from physical causes, including disability and chronic pain conditions, overlap with designing for people who have sensory processing issues leading to dyspraxia.

Interoception is a lesser-known sense that helps one understand and feel interpret internal sensations.People who have problems with interoception(typical in autism)may have trouble knowing when they feel hungry/ full, hot/cold or thirsty, and even in distinguishing these physical sensations from emotions.This can make managing self-regulation (including of emotions) a challenge. It also impacts on interpersonal relationships, and on socialisation. Problems with interoception underlie alexithymia.(difficulty processing, recognising and interpreting emotions in self and in others). From the perspective of the individual, they may frequently find themselves in a position where they are unable to express how they are feeling, and sometimes even to process and identify what they are feeling. Is a stomach-ache the really anxiety, or a tummy-bug or just the consequence of a skipped meal? This can happen in people who are not intellectually disabled and who are otherwise capable of verbalisation, but not when it come to expressing their needs. That is in effect what the term "selective mutism" refers to: not to being silent by choice, but rather not always being able to

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[13]***Trott M, Driscoll R and Pardhan S (2022) The prevalence of sensory changes in post-COVID syndrome: A systematic review and meta-analysis. Front. Med. 9:980253. doi: 10.3389/fmed.2022.980253***

verbalise ? We need to remember too, that all behaviour is a form of communication, including avoidance or meltdown. Meltdown in someone with a known diagnosis of autism is a great deal easier to spot than avoidance, where there is no diagnosis of a neurodivergent condition, or an undisclosed diagnosis. Avoidance means staying away from places or situations that trigger overload. In addition to avoiding sensory overload, autistic people may also seek to avoid cognitive overload (as may people with dementia) and avoidance of social contact. Lack of familiarity, and poor design and sensory characteristics can tip a user towards overwhelm. Quite apart from the material and spatial characteristics of a place, its other occupants are very often the source of sensory overload. They can't be "designed out", but we can build in in flexibility and choice, at all scales, so that we make places for everyone.

Fig. 2 Overload

In autistic and neurodivergent people, problems with interoception may co-exist with other sensory issues relating to movement,

balance and co-ordination, and physical or sensory disabilities. While the architect may not be able to address this sense directly though design, it can be approached indirectly through provision of quiet or "escape" spaces, (e.g. courtyards, gardens), alternative quieter routes through a building, campus or neighbourhood, (e.g. pedestrian routes) and by designing public or shared spaces so that they are calming rather than unavoidably over-stimulating, It should be stressed that it is human nature also to seek out sensory stimulus: crowds, busy environments, even occasionally, but for many people this is anathema.

Sensory hypersensitivity can manifest itself in being easily overwhelmed by loud noises, or discomfort in noisy settings, by bright lights, (which can cause eye pain and headaches), and strong smells. The last may not be as easily managed by the architect, but (s)she should be aware also of issues with outgassing and chemical sensitivity, which may lie at the root of olfactory sensitivity, especially in autistic people. Some common built features, for example involving parallel vertical lines of grids, can also cause problems with visual perception, or even trigger epilepsy or migraine. Many other people experience high sensory sensitivity, but not in a pathological sense. It is important to know the difference. In the design professions and in design research, they might become advocates for people who experience disabling hypersensitivity, as they possess some degree of personal insight. The devil is indeed in the detail, which will be addressed in future publications and lectures. Not all solutions are architectural e.g. assistive technologies, remote learning, behavioural training, and some

adjustments on the part of the person can help to remediate sensory mismatch between a person and their immediate environment[14].

Other challenges for neurodivergent users can be addressed though consciously tackling the legibility and navigability of the designed environment, by referring to and expanding on the existing knowledge base in relation to wayfinding, traditionally applied to larger complex settings, airports in particular, but also in residential setting of people with dementia. Going forward, designers need to draw first on a clear knowledge of who and what they are designing for moving forwards, but it is always worthwhile looking back occasionally, acknowledging previous knowledge, and good built exemplars.

In many parts of the world, the statutory and regulatory framework necessary to implement Universal and Inclusive Design is relatively new; some of us are privileged to have "grown up ' as designers alongside its evolution, and learned from being part of that journey. There is less and less value, particular in a western society focused on sustainability and re-use, in endlessly proclaiming that Universal Design and accessibility need to be built in from the start. Much of what the architect deals with, either within an existing building or an external or urban context is decades older or more, where universal design was not an initial consideration. Change is slow, because the scale of the required change is enormous, with multiple stakeholders involved, and can often only be tackled by addressing the task incrementally, even where fully supported by policy.

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[14] *Doyle, N.* Neurodiversity at work: a biopsychosocial model and the impact on working adults, *British Medical Bulletin, Volume 135, Issue 1, September 2020, Pages 108–125, https://doi.org/10.1093/bmb/ldaa021*

Architects and other designers of the built environment can help increase the rate of change by fulling embracing on board the idea of Design for Neuroinclusion, in the way we have embraced sustainability.