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Neurodivergent Themed Neighbourhoods as A Strategy to Enhance the Liveability of Cities: The Blueprint of an Autism Village, Its Benefits to Neurotypical Environments

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Abstract: In the next decades, it is expected that there will be a significant number of adults living with Autism Spectrum Disorder (ASD) who will continue to strive in the neurotypical environment. Despite the recent rise of developments that deviate from the institutional type of facility, many parents continue to voice their struggle to find safe and appropriate living environments for their adult children. The problem is not just the limited option on where to live, financing a home is also another dilemma. Thus, the challenge to provide appropriate living environments coincide with the need to provide meaningful opportunities that allows them to thrive and function in the society. This paper explores the existing design guidelines through recommendations on how spaces can be articulated by considering the value of savant skills and productive vocational skills for individuals living with ASD. This optimistic approach hopes to enlighten built environment practitioners in designing spaces where different populations can co-exist, particularly those with varied abilities. The environmental needs of ASDs and the proposed spatial interventions also extend its benefits to the well-being of neurotypicals. In addition, the participation of the ASD population in the built environment bridges accessibility and spatial experience. Therefore, designing neurodivergent neighbourhoods can be employed as a strategy to improve and enhance the liveability of urban regions.

Keywords: liveable; autism housing; well-being; inclusive neighbourhoods; sustainable communities

1. Introduction

The trend of globalisation is rapidly changing contemporary cities, posing threats to their liveable quality. Examples of complications include confusing network systems, dysfunctional social spaces, and competitive employment opportunities. More importantly, what defines a city's liveability is the comfort and safety of its neighbourhood. Its physical characteristics are therefore significant as they are the key to a sense of community which is referred to as a feeling of belonging [1]. Thus, neighbourhoods must support people of diverse backgrounds. A neighbourhood's key component is the dwelling, which is said to be an important anchor of an individual. Dwellings should offer privacy, safety, and allow the individual to have full control of it. The meaning it has for people lies in the functional relationships between its features, on one hand, and goals and intentions of people on the other [2]. A dwelling therefore can have varied functions since people give different meanings to it [2,3]. As such, it is an important element of urban regions because it reflects people's personal relationships to their environment. This conception is especially pertinent to individuals living with Autism Spectrum Disorder (ASD)—who have a unique spatial interpretation [3–5].

In the next decades, it is expected that a significant number of adults with ASD will continue to strive in the neurotypical environment, since currently one in one hundred and sixty children are

diagnosed with Autism Spectrum Disorder [6]. Autism Spectrum Disorder (ASD) is defined by the World Health Organization as “a range of conditions characterised by some degree of impaired social behaviour, communication and language, and a narrow range of interests and activities that are both unique to the individual and carried out repetitively” [6]. This physiological umbrella influences their distinct understanding of the world that surrounds them, resulting in the obscure description of an appropriate environment for individuals with ASD. Despite the recent rise of residential developments particularly in Western countries that deviate from the institutional type of facility (e.g., the specialist care centre in North Shields, Newcastle, England [7]), many parents continue to voice their struggle to find safe and appropriate living environments for their adult children [7,8]. Furthermore, ASD individuals themselves residing in a neurotypical environment long for a neighbourhood that will accept their unique condition. The incomprehensibility of society is a frequently recurring theme in the studied autobiographies of people with autism [5]. Contemporary society does not give the authors something to hold on to in understanding what this world is all about; their life stories reveal a continuous struggle for some grip on the world around them [5]. In the survey conducted for this research, all participants complained about being disturbed by the noise from their surroundings (i.e., vehicles and people). An anonymous individual even wrote that he did not like his neighbourhood, the reason being that “They only care about their welfare and treat people with a lot of prejudice; also gossipers”. Such sentiments describe the challenges brought by the complexities of contemporary urban environments.

Given these circumstances, this paper presents a conceptual framework of an Autism Village which hopes to prevent the population group from being socially isolated. The first section is an evaluation of existing design guidelines. This proceeds with a proposal of spatial interventions that embraces the individuality of ASD individuals. As the trait of every individual may vary, the approach is to value the savant skills—which is commonly evident in ‘high-functioning’ ASDs; and the productive vocational skills—that would support those of the other disposition. Designing spaces with this in consideration gives the individuals living with autism an opportunity to maximise their potential as human beings. Hence, the environment become meaningful since it enables its users to thrive and function. Following this, a vision of housing typologies illustrates a possible translation of the proposed spatial interventions to the physical design of ASD living environments. Towards the end of this paper, a section is dedicated to discussing the urban design principles of Kevyn Lynch [9] from his book, *The Image of the City*. This is aligned with the conceptualised framework of an ASD-friendly environment to demonstrate its benefits that extend to neurotypicals.

This research aims to shed light on the benefits of considering neurodivergents, in this case the ASD individuals, as huge contributors that can shape the quality of urban spaces. The proposed optimistic approach of designing ASD-friendly environments hopes to enlighten built environment practitioners in creating spaces where different populations can co-exist, particularly those with varied abilities. Apart from the opportunity for neurotypicals to see the potential of individuals living with autism, the proposed spatial interventions together with the established environment needs of people with ASD (e.g., clarity in the zoning of spaces; quality green spaces) can benefit the well-being of any individual, whether a neurodivergent or a neurotypical. In addition, the participation of the ASD population group in the built environment can enhance the qualities of cities by bridging the gap between accessibility and spatial experience [10]. The explored unconventional home design also substantiates the new urban typologies. It demonstrates that the efficacy of typologies is not necessarily bound to its conformity with the surrounding urban fabric. It is rather determined by the beneficial experiences it brings to its users. From all these grounds, designing neurodivergent neighbourhoods can be employed as a strategy to improve and enhance the liveability of cities.

2. Methodology

Relevant literature is the predominant source of information for this paper. This includes published research, peer reviewed journals, online resources (i.e., from websites of autism

organizations), and design guidelines formulated by ASD-friendly architecture specialists. Earlier studies in sciences are regularly contested by modern advancements—even Leo Kanner, the pioneer researcher of autism, initially described it as a unique condition he called ‘inborn autistic disturbances of affective contact’ [11]. Only twenty-eight years later was when he was able to identify the varying inherent characteristics of the spectrum [11]. Despite the amount of information readily available, many studies have highlighted that the ASD individuals risk disappearing from view in designing ASD-friendly environments [3,12,13]. This is because architecture has not been an evidence-seeking culture [14]. Significantly, ASD individuals should be engaged in the process to understand the autistic mind [15]. Therefore, this research put the participation of ASD individuals forward in the process of conceptualising the proposed framework.

Before recruiting the participants, ethics approval was received from the The University of Edinburgh where the researcher is enrolled as a postgraduate student at the time of writing this paper. The participants invited are Filipinos of any gender and aged eighteen and above. The reason being (1) living environments specifically designed for ASD individuals are yet to exist in the Philippines; (2) the research targets the adult ASD population group; (3) to investigate if culture has a direct influence on their spatial preferences. The survey was done in the form of a questionnaire which was sent through electronic mail, the preferred mode of communication by the interested participants. The questions were derived from a review of existing literatures that established the ‘common’ attributes of ASD individuals [6,8,11,16–34] and ‘appropriate’ environments for ASD individuals [3–5,12–15,35–43]. Since qualitative data is most relevant and significant for this study, most of the questions are intentionally subjective (see Appendix A). This is to encourage the participants to freely give their insights. In cases where the individual cannot express his or her opinions, the questionnaire was answered by a family member who can best discern what is most suitable for them or how the individual would have answered it. Accordingly, the participants’ identities are not revealed in this paper. Where the statements need to be supported by the survey results, they will be referred through personal pronouns or the word ‘Anonymous’.

To obtain their subjective preferences, the questions included are (1) the type of home they prefer to live in; (2) what do they wish their house could have been; (3) if there is anything in their current home that they would like to follow for their new home; (4) what do they like or dislike about their neighbourhood; (5) what features do they want their neighbourhood to have; (6) what indoor and outdoor places they like and dislike; (7) what outdoor activities, hobbies, and special interests they enjoy; (8) how do they feel when they are doing these activities; (9) if they like and are fine to meet and live with fellow autistic individuals; (10) if they want or have a pet; (11) what is their daily mode of travel; (12) do they work, if yes, what do they do for living; (13) the type of neighbourhood they prefer to stay in. They were also given some environment characteristics to choose from, such as (1) trees and plants; (2) bright or earth tone colours; (3) noisy or quiet; (4) natural daylight or artificial light; (5) enclosed or open spaces; (6) big or small spaces. As mentioned, one of the aims in selecting the profile of the participants is to assess whether culture affects their spatial demands. Hence, also included are questions that relate to culture and traits observed among Filipinos (i.e., close family ties [44]; living a life of devotion [45]). With this in view, the participants were also asked (1) who they want to live with; (2) do they like family gatherings and celebrate events with them; (3) what is their daily routine.

3. Results

Out of the ten questionnaires disseminated, five responses were received. Common answers are the wish for (1) huge windows; (2) big green and open spaces to accommodate sports and leisure activities; (3) a quiet and peaceful neighbourhood. All participants (1) like to have a pet (particularly dogs); (2) travel by car (self-owned and family-owned); (3) Enjoy sports (i.e., swimming; basketball) as outdoor activity. Everyone had no issues with their house. Three individuals like the rooms (e.g., bedroom; playroom) where they can engage with the activity they enjoy (e.g., playing with x-box;

Son-rise program), while two individuals like their garden. This also aligns with the results where 60% of the participants' favourite place are the features of their home (i.e., living room, bedrooms, and garden). However, they all dislike their neighbourhood, particularly because of the noise from the surrounding vehicles and neighbours. A landed house in a town setting is the preferred living environment by all the participants. Another similarity with non-autistics that can be considered is everyone's dislike for crowded, hot, dirty, and bad-smelling places. However, nobody had issues living in a neighbourhood with fellow ASD individuals. Just one individual was particular about it; he wrote "as long as he/she follows the house rules and is organized and tidy". As a matter of fact, they like to meet other ASD individuals, especially if they have shared interests. According to an anonymous individual, his reason for wanting to meet other individuals with ASD is "... to prove those autistic people ... there are some people using the word AUTISM for some moduses". Filipinos are generally regarded as having very close family ties. This is evident in the annual (extended) family gatherings and aged parents who live with their adult children [45]. However, the survey results showed that three out of five prefer to live alone, along with not being fond of celebrating events with family members. They can be overwhelmed and experience meltdowns due to the amount of people, regardless of their personal relationship with them. The dominance of the Catholic faith in the country echoes in the everyday life of Filipinos [44]. Despite this, only one participant answered with a daily routine of prayer before leaving the house. The survey results were vital for the study because of the consistency of the responses. These results and the only available culture-related studies that focus on the diagnosis and treatment of ASD (e.g., The Impact of Culture on Autism Diagnosis and Treatment [46]; Cultural basis of social 'deficits' in autism spectrum disorder [47]; Culture and Autism Spectrum Disorders: The Impact on Prevalence and Recognition [48]) do not prove, but suggest that physiology prevails in the way they connect with their surroundings [3–5].

4. Limitations of the Study

Cultural dimensions in detail were not covered in this paper because of the limited time in conducting this research. Nevertheless, it is recommended that future developments of this study investigate the impact of varying cultural background of the autistic populaces—such as the effects of religious practices, beliefs and traditions, ethnicity, and sexual orientation. Moreover, it is also crucial to explore the desires of the family members of the ASD individuals. Even though the researcher is aware of ASD individuals' critical issue of financing a home, this study did not assess the cost and funding to develop the conceptualized housing typologies. However, it is advisable for following studies to include an evaluation of a constructed project to help readers determine the budget and affordability of such developments.

5. Overview of Existing Design Guidelines

With the rising awareness of the need to support the ASD population group, numerous design guidelines for ASD-friendly environments have materialised. The first design framework is the Autism ASPECTSS by Dr. Magda Mostafa [35]. She is a world leading expert on designing built environments for autism. ASPECTSS is an acronym for acoustics, spatial sequencing, escape, compartmentalisation, transitions, sensory zoning and safety [35]. Eventually, more design guidelines emerged such as How to Create an Autism-friendly Environment [36]. Specialist architects also began formulating some based on their personal experience dealing with ASD individuals and designing ASD-friendly environments. Examples of this are Autism and Architecture [37] and Design Environments for Children and Adults with ASD [38]. The solutions in all these guidelines tackle the physical aspects of ASD spaces (e.g., the clarity and sequencing of spaces; sensory zoning; colour and material) in relation to the attributes of people with autism. However, the type of environment these guidelines apply to is controversial. The school environment is often mentioned in these guidelines while there are no indications of other settings like residential and workplace. There is also uncertainty in the consideration of the different life stages of an ASD individual. Apparently, it appears that environment

perceptions of ASD adults may differ from those of children. Environments also have direct effects on the phenotypic expression of ASD throughout adulthood, and thus should be considered and further studied [16]. Therefore, the ASD-friendly parameters established in these guidelines need some clarification.

According to the design journal by Bauers et al. [13], the material environment may afford more possibilities of use and have a more prominent meaning than design guidelines imply. The direct effects of their physiology influence their distinct spatial experience. Spaces and objects reinforce their sense of identity and reflect their deepest inner feelings [13]. The diversity of their phenotype is a factor that complicates the definition of ASD-friendly spaces. Sometimes more than the human beings, they seek comfort in the spaces that surround them. For instance, in unsteady situations they seek comfort in reliable spaces, where they find a tangible source of peace and safety rather than seek comfort with other human beings [4]. Although the opposite can also happen if an individual cannot relate to his surroundings. This implies that exploring the material aspect of an environment (e.g., colour, texture, acoustics) is not sufficient when people with ASD are the users. Even for Dr. Mostafa [39], “autism, is an extremely complex condition which affects each person differently, autism-friendly design requires a conceptual framework to be interpreted rather than set of hard-and-fast rules”.

According to *Tomorrow’s Big Problem: Housing Options for People with Autism* published by The National Autistic Society [40], the most limiting factor for people with a learning disability or an autistic spectrum disorder is the shortage of accommodation and the narrow range of options from which to choose. With this in mind, a set of guidelines have emerged specifically covering design of living environments for individuals with ASD. Besides the Autism ASPECTSS [35], Dr. Mostafa Magda also developed the *Housing Adaptation for Adults with Autistic Spectrum Disorder* [41]. Parallel to her other guideline, the recommendations also covered the material aspect of an ASD living environment. Eventually, a more comprehensive document was published—the *At Home with Autism: Designing Housing for the Spectrum* [14]. It introduces design practitioners, service providers, and public officials to strategies of linking quality of life to home design. The document chapters [14] discuss topics such as (1) How housing services can be improved; (2) What design features respond to ASD; (3) The possible housing types and neighbourhood selection. It also includes images of precedents to help the readers better visualise the recommendations.

Therapeutic provisions—such as Educational and Behavioural Therapies and Animal-assisted Interventions—has immensely advanced in the past decades [49–51]. For this reason, a substantial number of ASD individuals have shown improvements as they grow older. Nowadays they are observed to be more capable for employment, able to live ‘independently’ and develop ‘meaningful’ social relationships [17–19]. The success and need to become independent influenced the move, particularly in Western countries, to look at other concepts of residential design. Instead of the usual institutional type of environment, the village setting was introduced and is still encouraged in future developments [1,7,11,40,42]. However, its effectivity is contentious, especially to the parents of the ASD individuals. To them, residential environments must meet the concept of independent living and avoid social seclusion [7,8]. Such friction opens an opportunity for the existing design guidelines to be reviewed and, respectively, interventions should be introduced as reinforcements.

6. Interventions to Existing Design Guidelines

The sad reality is that the neurotypical society globally is still unwelcoming for ASD individuals. According to the World Health Organization [6]—worldwide, people with ASD are often subject to stigma, discrimination, and human rights violations. Many parents also recounted trouble finding work environments that would accept their children and provide necessary supports for them to be successful [8]. In comparison with other disability groups, both underemployment and unemployment rates are high in the ASD population [8]. Often, those who are employed only work for a few hours and only earn a minimum wage [8,16,17,20]. Therefore, the problem is not just the limited option on where to live, financing a home is also another dilemma. The challenge to provide appropriate

living environments coincide with the need for meaningful opportunities that allows them to thrive and function in the society. Taking this into account, this chapter will introduce the savant skills and productive vocational skills in the articulation of ASD spaces.

6.1. Savant Skills in ASD Individuals

Savant skills can be evident in any human being, whether neurotypical or neurodivergent. However, the condition in which both prodigious and talented savants are mostly frequently reported is autism spectrum disorder [21,22]. “Autistic savant” refers to individuals with autism who have extraordinary skills not exhibited by most persons [23]. This is the reason why affinities are apparent in individuals with ASD. However, these talents are viewed by some as deficits because of the chances that ASD individuals can become obsessed with it. Regardless, present therapies particularly in the school setting, notice that children have better participation when the activities are in accordance with their interests [24]. Students with ASD present a variety of academic, social, and behavioural challenges in the school setting, but strategies need not be deficit focused [24]. Interventions can be more motivating and effective—when teachers remember the importance of considering individuality and choose to channel the power of each student’s natural strengths [24]. The parents indicated that their children showed greater-than-expected learning when that learning was interest-based [25]. The study of Koeger et al. [26] also revealed that interest-based activities resulted in high levels of initiative to interact with other people. This is also supported by the result of the survey conducted for this research where all the participants wrote about their happiness and excitement when they are engaged with their interests. What was interesting is their enjoyment of meeting fellow individuals with ASD, especially if they share a common interest. Despite the findings that validated the benefits of supporting their interests, the majority of the adults with ASD are unable to take advantage of it. This is due to the lack of opportunity to use these talents after school years. Base on the study by Howlin et al. [21], only a small percentage of the individuals had succeeded in using these skills to find permanent employment. For the majority, the isolated skill remained just that—leading neither to employment nor greater social integration. The fact that they are aware of their difference is further aggravated by not having anything to be proud of [18,27,28]. This may cause the adult onset of psychiatric problems (e.g., anxiety and depression) [18]. Although, even to this day, opportunities to use these skills are rarely available, there is no solid evidence that they lose these.

Spatial Articulation in Relation to Savant Skills in ASD Individuals

The need to emphasise these gifts is undoubtedly valuable to the well-being of ASD individuals. The practical challenge now is to determine how individuals with special skills can be assisted, from childhood onwards, to develop their talents in ways that are of direct practical value, thereby enhancing their opportunities for social inclusion as adults [21]. This merits the savant skills as a criterion in designing ASD-friendly environments. If to be considered, how then does this translate to or affect the design of spaces for ASD?

Dr. Temple Grandin is a prominent ASD individual because of her successful career in the field of Animal Science. She is one of the first to speak about her personal experiences with autism. Grandin identified the basic types of specialised minds found in people with autism. People with autism are commonly visual thinkers, pattern thinkers, and word fact thinkers [29]. Visual thinkers are adults who rely on their visual strengths often excel most in jobs such as graphic design, computer animation, architecture, working with animals, and industrial design [27]. Pattern thinkers are a good fit for computer programming, mathematics, and statistics [27]. Technical writing, journalism, record-keeping jobs, and specialised sales jobs are often the best options for individuals who are word-detailed oriented [27]. Corresponding to this, suggested articulation of spaces are as follows:

- Productive Respite Spaces

Autism-friendly environments can feature spaces that are themed according to the common interests and strengths of ASD individuals. Instead of an indeterminate description of a quiet and neutral space with safe boundaries, as recommended in the existing design guidelines [35,37], it is possible for interest-themed spaces to also function as ‘escape’ spaces. The positive emotions inhibited from these spaces can help them find respite from the overstimulation of their surroundings. In the survey questionnaire for this research, all participants gave a positive response of being happy and excited when they are doing the activities that are related to their interest. An anonymous individual specifically wrote that besides the excitement, he “also doesn’t feel lost”.

- Spaces as Sources of Livelihood

Environments for all ASD individuals must provide and support a good quality of life. This shall include options for them to independently sustain their future. Providing work and recreational activities give meaning to their existence and bring a sense of accomplishment [52]. In line with this, start-up spaces are sensible in ASD environments. For example, those who are interested with music can earn through performances or teaching; those who are fond of computers can open an internet and gaming café. The chance to be productive boosts their self-esteem and can yield great financial returns. Thus, ‘spaces as sources of livelihood’ transforms the savant skills into meaningful opportunities.

- ‘Interest-thing’ Social Spaces

Activities can be linked to parts of spaces [3]. Besides the usual furniture found in social spaces (i.e., chairs and tables), it can also be equipped with tools that involves the interests of ASD individuals. For example, paint or art materials for those who are gifted and interested with art. ‘Interest-thing’ social spaces can also serve other purposes, such as for assistive workshops where ASDs without intellectual disability work as behaviour technicians to those with intellectual disability [53] who share their interest. Additionally, having the opportunity to discuss daily challenges and struggles with others who see and experience things in a similar way seemed to be very reassuring [30]. As mentioned earlier, all the ASD participants invited for this research like to meet fellow ASD individuals. One individual even highlighted that he likes it, especially “when we talk to share things we do in common (autistic traits)”.

6.2. Productive Vocational Skills

Although savants are most evident in individuals with autism, their varying intellectual and cognitive ability can affect the way these gifts manifest. In the majority of the reported cases, this ability falls within the mild learning disability range or above [22]. However, this does not mean that individuals who belong to the other disposition are to be ignored. More than the academic capability, vocational skills robustly support an ASD individual’s road to independence [19,31]. Research has proven that great vocational independence led to subsequent improvements in maladaptive behaviours and even the core features of autism in adulthood [16]. The problem is that most therapy centres lack the programmes that allow these individuals to display how it is used by typical adults to obtain gainful employment [20]. ASD adults are usually engaged in activities that do things designed for young children (e.g., colouring in children’s colouring books, stringing toy beads, putting pegs in pegboards, or manipulating other pre-school-type materials) [28]. Such activities usually have little if any impact on helping them function as adults [28]. Significantly, there is a need to not only look at the type of activity but also the number of hours they spend in these activities to obtain a more complete picture of employment and daytime activities [32]. Unlike the savant skills that are natural to an individual, ASD individuals may lose these skills if not being used despite knowing it since their younger years [28].

Apart from the insufficient support to develop skill sets suitable for adults, the bleak perception associated with autism also decreases their chances of finding opportunities to utilise these. Even to this day, businesses are reluctant to hire individuals who have autism [20]. Moreover, their inherent characteristics (e.g., heightened senses and anti-social behaviour) may pose challenges to their independent performance [33]. On top of this, the workplace environments designed for neurotypicals can cause the onset of behavioural issues. The connotations and meanings attributed to the built environment in our society can lead to situations in which people with autism do not behave themselves according to the rules people without ASD inherently connect to it [5]. For instance, the type of lighting or the compartmentalised layout can confuse and overwhelm an ASD individual. From the survey conducted, three out of five individuals prefer daylight over artificial lighting. An individual responded that he do not like indoor spaces with blinding lights (i.e., exposed bulbs). Their love for routines may also cause discomfort when unexpected changes happen [33], such as due to renovation or reposition of furniture. This is the reason why all the existing design guidelines recommend that ASD spaces must have clear forms and distinct functions [14,35,37,41].

Spatial Articulation in Relation to the Productive Vocational Skills

The previous discussion is two-fold. First is the need for ASD individuals to know how these skills are applied in real life situations. Second, their spatial perception that is linked to their inherent characteristics [3–5] can affect the way they perform. As a proposal, simulation of workplace environments can be given attention in ASD environments. These spaces replicate various employment atmospheres, allowing the ASD individuals and support assistants to play the actual roles in work places. This method of learning gives an overview of its proper utilisation, resulting in a better understanding of the consequences of its application. Additionally, this spatial feature expands their familiarity to various workplace settings [52]. Hence, the simulation of such spaces can allow ASDs to easily adapt to the actual environment. The predictability and perhaps indisputable perceptibility of the physical space can inspire confidence to the ASD individuals [5]. Programmes can be introduced to make it function like the actual ones. For instance, the replica of a café or restaurant can occasionally be open to the public. Correspondingly, ASD individuals are introduced to financial management. As a result, the inclusion of simulated workplaces to ASD environments increases their cognisance of the concept of vocational skills, and at the same time it serves as a platform for neurotypicals and neurodivergents to interact. Improving understanding of social interactions and relationships has the outcome of decreasing feelings of depression and anxiety [30]. Ultimately, it presents an opportunity for neurotypicals to experience the potential of people living with autism.

7. Visions of Housing Typologies

The home environment is the foremost contextual place to be considered due to the powerful physical, psychological, emotional, and spiritual significances in our lives [43]. Apart from the need for living options, also pointed out earlier is the issue with the current residential concepts that supports the independence and social integration of ASD individuals. Home is taken by ASD autobiographers as a prominent place in the world since it is the one “sanctuary” that they can control [3]. The homes and neighbourhoods where ASD individuals live affects the quality of their life [14]. Culture is a significant factor when designing homes since this may affect the way people think of and use a dwelling [2]. However, for people living with autism, their spatial experience is dictated by their physiology [3–5]. This is also implied by the consistent responses of the ASD individuals who participated in this research along with the absence of studies on the impact of culture to the attributes of ASD individuals. Despite this, articulation of spaces may still vary depending on various factors, such as differences in family culture and environment context, which needs further investigation as suggested in the limitations of the study section of this paper. Hence, the succeeding illustrations are mere examples of how the proposed spatial interventions can be incorporated to the living environments of people with ASD. An analysis of the surrounding area is also excluded since the site is hypothetical.

The concepts are derived from (1) At Home with Autism: Designing housing for the spectrum [14], (2) Preferences of ASD individuals collated from the questionnaire disseminated for this research, and (3) The proposed spatial interventions to ASD-friendly environments (i.e., ‘Interest-thing’ Spaces and Simulation of Workplace Environments). The reasons for exploring a neighbourhood design are (1) living options for people with autism is still inadequate [14,40], (2) the survey results show that ASD individuals like to meet and share their interests and challenges with fellow ASD individuals [30], (3) for ASD individuals with varied intellectual abilities to support each other [53] and prove themselves as desired by a participant of this research, and (4) ASD individuals can share the spatial features of each zone and socialize with other ASD groups.

The residential structures are organized in a linear position (see Figure 1). The simple and straightforward plan makes the access and security easier to control. It is important for this to be considered since the proposed neighbourhoods are also for the public to support the strengths of the ASD individuals. Navigation and way-finding are important skills that must be facilitated for the autistic user [41]. Having a main artery avoids confusion, giving a clear direction to the various residential zones. The ‘interest-thing’ spaces, leisure facilities, and the simulated workplace environments are located along this to make it visually engaging [14]. By positioning the proposed spatial interventions at the centre of each zone, the meaningful activities also function as landmarks.

Table 1.1 Various residential building types and living arrangements

| RESIDENTIAL BUILDING TYPE |
|---|
| Independent detached home (a.k.a. SFH) |
| Independent attached home (e.g. townhouse) |
| Cluster of detached homes, no shared/common spaces (e.g. planned residential development) |
| Cluster of detached homes, shared/common spaces in separate buildings on property |
| Attached home, 2–5 units (e.g. duplex, triplex, four-plex) |
| Attached home, 6 or more units (e.g. apartment, condominium), no shared or common spaces |
| Attached home, 6 or more units, with shared or common |
| Attached efficiency units or guest rooms (e.g. single-room occupancy housing) |
| RESIDENTIAL LIVING ARRANGEMENT WITHIN HOME |
| Solo or alone |
| With family |
| With self-selected friends or housemates, no live-in care providers (referred to as “shared housing”) |
| With agency/provider-selected housemates, no live-in care providers |
| With roommates and live-in care providers (often referred to as “group home”) |
| With spouse or domestic partner (with or without children) |
| TYPES OF CARE AND SUPPORT IN HOME |
| None |
| Supported: with personal support providers living off-site |
| Supervised: with support providers living on-site or with working office on-site |
| Long-term institutional care: extensive services spaces on site, staff present during sleeping hours, some staff may be live-in |
| Transitional training: supported or supervised, but intended only as temporary |

Figure 1. Various Residential Types and Living Arrangements of Individuals with ASD [14].

The proposed neighbourhood (see Figure 2) is zoned according to the documented living arrangement preferences and level of independence of ASD individuals (see Figure 1) [14]:

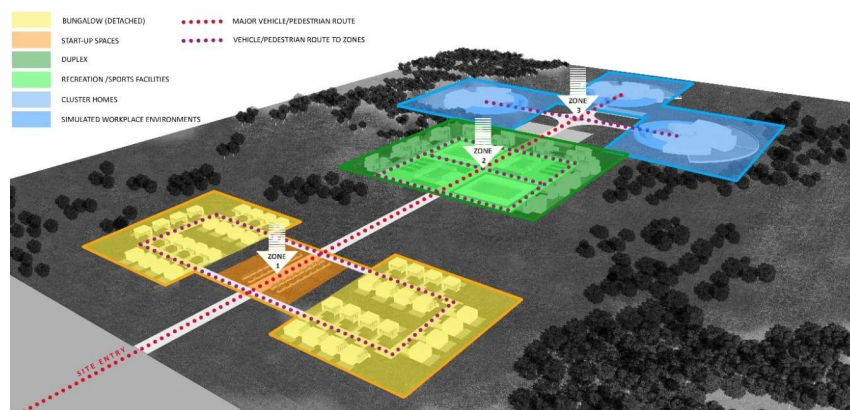


Figure 2. Proposed zoning of the autism village.

7.1. Proposed Zoning

- Zone 1

The first zone, which is located along the site entrance, caters to ASD individuals who are independent and prefer to live alone. Positioned in this area are the detached bungalows. Adjacent to these residences are start-up spaces that give the ASD individuals an opportunity to have their own source of livelihood. These spaces are located independent from their home to encourage them to come out and socialize. Opportunities to develop relationships within the community and with neighbours have positive effects on the physical and mental health [14].

- Zone 2

The second zone is for the duplex units. This housing type targets ASD individuals who are independent and comfortable with being around other people. These units bound a huge open space to accommodate a variety of sports and leisure activities. Sports is a consistent favourite among the ASD individuals who participated in this research. Neighbourhoods that support physical activity are highly encouraged in neighbourhoods for ASD individuals [14]. Autistic adults tend to have higher cholesterol, resulting in an obesity rate that parallels the general population [14]. An anonymous ASD individual pointed out that what he likes about sports is it makes him lose weight. This recreation area is also to support the motor skills and vestibular system of the ASD individuals residing in the other zones.

- Zone 3

The last zone is for cluster homes, a living option for ASD individuals who need support and supervision. The simulated workplace environments at the main entry controls people's access to the residences. The two other zones serve as a buffer for this ASD group who have the tendency to wander and are unable to determine potential danger in public spaces. Hence, the residential spaces are positioned at the far end of the site for safety and security.

7.2. Proposed Housing Typologies

Among the housing typologies, the detached/attached houses are viable in meeting the requirements of individuals with autism and their families because it provides flexibility for changes and better accommodate structures for gross motor activities [43]. This typology is also explored since all participants of this survey preferred this type of home. The general architecture of the buildings is simple in form and minimalist in appearance to avoid sensory overload (e.g., sensitivity to texture, bright colours, pattern etc.) which may occur to some ASD individuals. It is consistent for all the

housing types since too many options may present ambiguities for individuals with ASD [14]. The huge windows allow the residents to survey their homes even before reaching it. In addition, a pleasant view of the nature and interests-related activities may prevent anxiety and disrupt the core symptoms of autism, such as their tendency to stare at certain objects. The outcomes of numerous studies [3,12] revealed that the amount of personal space varies in individuals across the spectrum. Hence, for the subsequent housing typologies, the proposed spatial area and ceiling height may seem to be bigger than normative residential buildings. The reason being, a large unit size is easier to re-configure when for instance, an individual is comfortable with small spaces, a big open plan can be compartmentalized. However, there are also some individuals whose defined space is atypical—for example, a participant for this research noted that he likes “a small auditorium turned into a house”. Adjustments to meet such preference is difficult when spaces are compact. Moreover, immense spaces have the flexibility to accommodate the changing needs of the ASD individual as they age. Most families also desire a large unit because most small units exacerbate their challenges—(1) lack of privacy, (2) limits activity with family members, and (3) it contributes to an increase in sensory stimulus—which thus intensify autism-related behaviours [14,43].

Relative to the proposed residential zones, the explored housing types are as follows:

- Bungalow (Detached) Homes—Zone 1

The Bungalow Detached House (see Figure 3) features a private social space in which the ASD individuals can spend time with their peers who share their interests. Locating it at the entry limits the guests' access to the residential building. This allows the ASD individual to select the persons who can enter their homes. Each unit also has its own green and open space at the façade and rear of the house. The one located in front demarcates the entrance, making it readily identifiable. The one behind is a personal quiet open space for when social interaction is not desired.

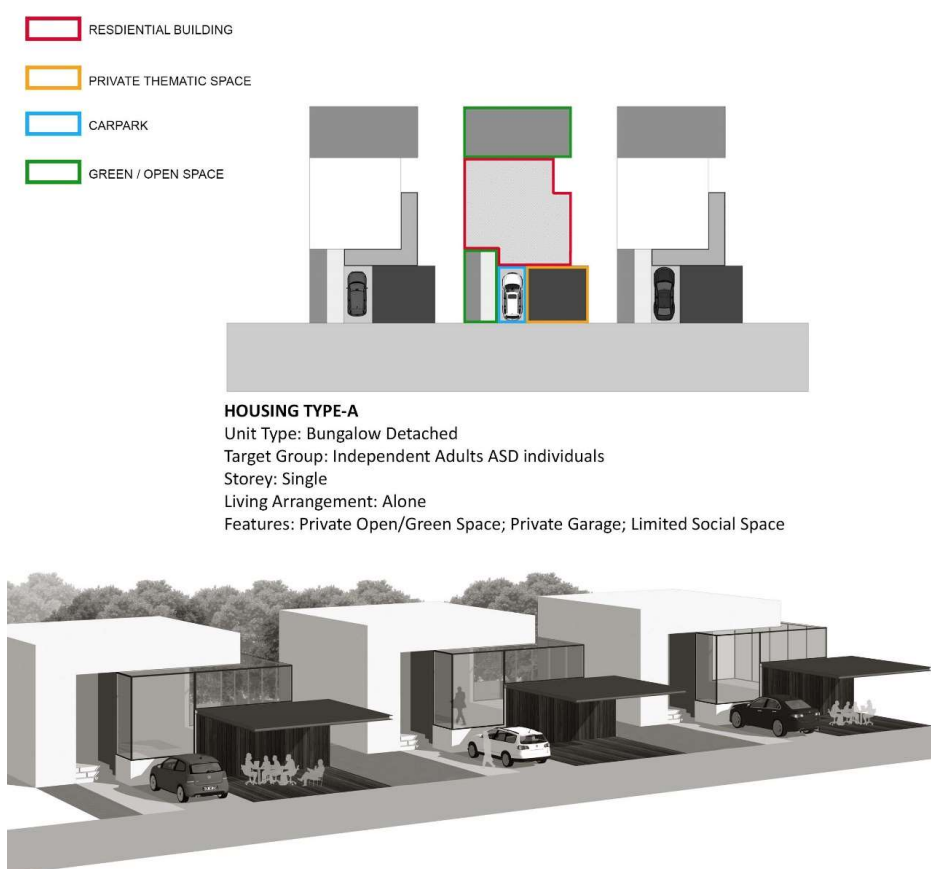


Figure 3. Proposed bungalow (detached) with private interesting space.

- Duplex Units—Zone 2

Compared to the former, the Duplex Units (see Figure 4) have a larger building footprint. The joined single and multi-storey units are options for the residents to choose from depending on the number of people they prefer to live with. In between two duplex units is a shared ‘interest–thing’ space. This space can be used to open small businesses that relate to the ASD individual’s interests and capabilities (e.g., car wash business for those who are fond of cars).

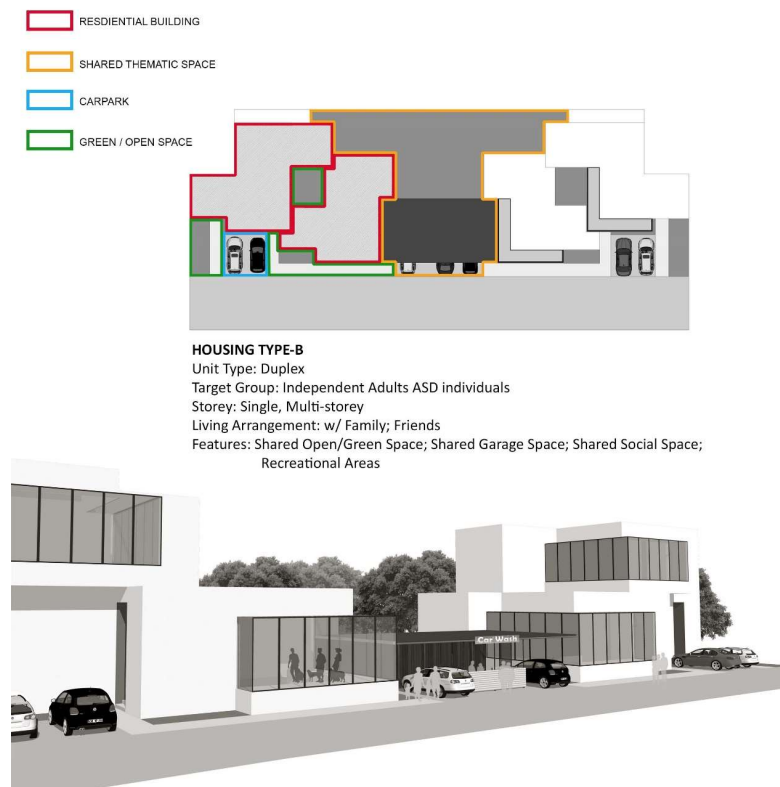


Figure 4. Proposed duplex units with shared interesting space.

- Cluster Homes

Since this is for the more delicate ASD population group, the access is secured by an administrative area at the entry. This will facilitate the simulated workplace environments that will open to the public on certain days. The Cluster Homes (see Figure 5) are enclosed by a huge green and open space which can be articulated to accommodate sensory gardens, vegetable farming, and animal–assisted therapies.

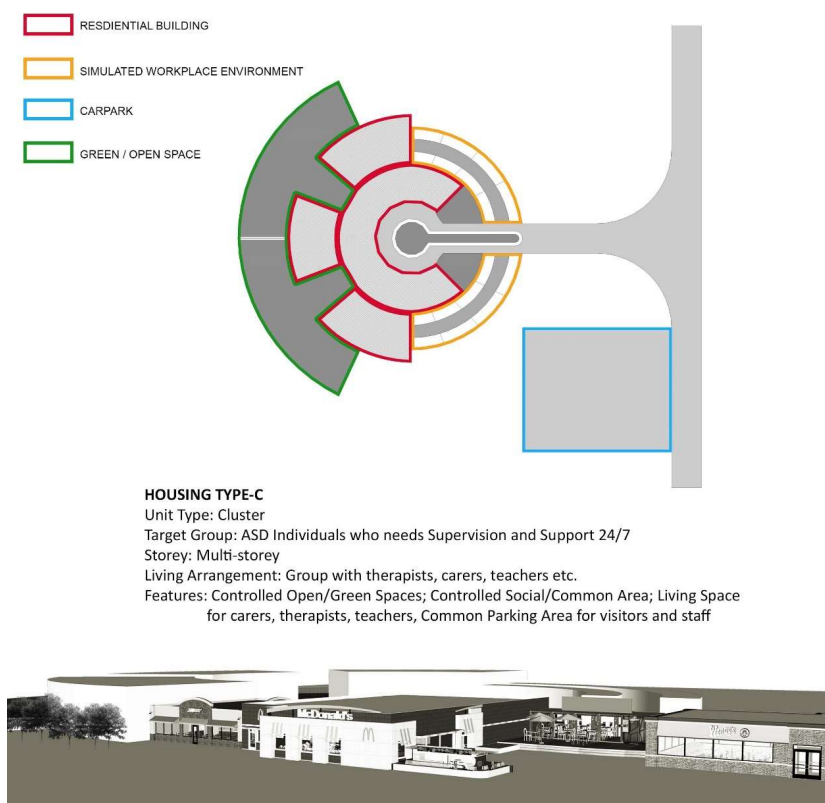


Figure 5. Proposed group home with simulated workplace environments.

The enhancements in the proposed residential setting supports the well-being of ASD individuals. More than just a place to live, the overall concept of the Autism Village brings an opportunity for the ASD individuals to exhibit their strengths and capabilities. There might, however, be a serious concern on the safety of the residents since the proposal is to open the community to the public on certain days. But to achieve the broader goal of social inclusion is not exclusively contingent upon the individual [14], there is also a need for the neurotypicals to accept and appreciate them.

8. The Benefits of Considering Neurodivergents in the Design of Neurotypical Environments

Everyone has the right to enjoy the city they inhabit. A city must provide quality services that significantly serve the well-being of its individuals. The state of well-being, as defined by the World Health Organization [54], is the state in which every individual realizes her or his own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community. However, the trend of globalisation is rapidly and constantly changing the facets of cities, posing threats to their liveable qualities. Worldwide, unprecedented urban growth strains the quality of life on many levels—walkability of streets, sociability of public spaces, access to recreation and nature, the journey to work, assault from urban noise, safety, health, and much more [55]. Because of this, contemporary cities are becoming more exclusive and less adaptable. The availability of the options a city provides its inhabitants is decreasing. For instance, the sensory demands, social ambiguities, and information complexities are among the barriers that the modern 21st century presents to autistic people [34]. This also extends to neurotypical older adults and their families who have the dilemma of finding a place to live as they age, since residence options and care services may not be available [56].

Aside from enhancing the environments of people living with autism, this paper also proposes an urban design strategy that considers the spatial needs of neurodivergents to improve the environment qualities of cities. Disabled people's involvement may contribute to a more inclusive built environment

by bridging two concepts architects tend to consider as unrelated, that is, accessibility and spatial experience [10]. As this is yet to be tested, credible literatures will be used to support this proposal. The succeeding section will discuss the elements of a city—paths, nodes, edges, landmarks, districts—as described by Kevyn Lynch in his book *The Image of the City* [9]. The reasons for selecting this literature are: (1) it gives a general overview of how good city images provide success in understanding the urban environment; (2) the elements of a city identified are universal; they appear in any urban area.

8.1. Paths

A path is a way by which people reach a certain destination. Paths can be streets, walkways, transit lines, canals, and railroads [9]. Lynch describes this as a powerful means for an individual to find his direction. He recommends that paths should have identifiable markings, such as abrupt directional shifts, to enhance visual clarity. A better demarcation could be clear points of interests [14]. These points can be activities that are based on the characteristics of the people in the area. This can make paths visually engaging so people who move through it feel safe and secure. Parallel to this is the design of complete streets. Such streets are required when designing ASD environments because some people with autism lack awareness of personal safety. The benefit is not limited to the ASD population group. Complete streets safely accommodate all users—pedestrians, bicyclists, motorists, and transit riders—of all ages and abilities by providing dedicated areas for each travel mode [14].

8.2. Edges

Edges, as described by Lynch [9], are boundaries between two phases. Depending on the situation, sometimes a reachable form (e.g., fences and gates, planting) is a more effective boundary. Such elements are used to protect neighbourhoods against crime or disturbances (e.g., noise from neighbours) which cause stress and other detrimental effects to health. As for the mentally disabled population groups, fences are useful in preventing them from wandering and eloping. In some cases, ASD individuals may lose track of their body when unpredictable situations occur. An edge that is tangible in form offers a hold for them to position themselves in space [13]. However, edges may augment the tendency of districts to fragment the city in a disorganizing way [9]. Incorporating ‘interest-thing’ social spaces to the edges presents an opportunity for urban areas to become socially cohesive.

8.3. Nodes

Nodes are points in which an observer can enter. This definition suggests that nodes introduce people to their destination. The design criterion of predictability in ASD-friendly environments aligns with this. Giving a view of what’s in the background helps them to decide whether they should proceed to that space or not. This helps reduce overstimulation of the surroundings. In conjunction, Lynch suggests that giving a glimpse of a place such as the junction, or place of a break in transportation, has compelling importance for the general city observer [9]. Because decisions must be made at junctions, people heighten their attention at such places and perceive nearby elements with more than normal clarity [9].

8.4. Landmarks

Landmarks are references used by individuals for orientation and recognition. Therefore, locating residences proximate to various amenities can be important to individuals who do not drive or cannot afford personal automobiles [14]. According to Lynch [9], the need to recognize and pattern our surroundings is so crucial and has such deep roots in the past that this image has wide practical and emotional importance to the individual. Designing sequential landmarks can provide emotional security because it allows people to plan their movements ahead. This corresponds with continuity in ASD environments since ASD individuals have difficulty adapting to change. At Home with

Autism [14] stated that continuity can also be tied with the origin of a place. This can be achieved by retaining an old tree, a path trace, or some regional character.

8.5. Districts

This discussion concludes with the largest element of a city, the district. The physical characteristics that determine districts are thematic continuities which may consist of an endless variety of components—texture, space, form, detail, symbol, building type, use, activity, inhabitants, degree of maintenance, topography, etc [9]. Fundamentally, these constituents are interdependent. However, the image that result from these depend on the observer. Beyond the physical, the varying interpretations also conclude from its meaning to an individual. Taking this into consideration, large elements of a city should embrace its inhabitants' individuality. Spaces that present opportunities for an individual to engage in meaningful activity, such as the 'interest-thing' and simulated spaces, gives a person a sense of purpose as well as self-satisfaction, confidence, and autonomy.

Environments also constitute the people within it. Being scrutinised because of your difference (e.g., skin colour, facial features, social status, education) occurs anywhere in the world. Despite a myriad of opportunities being present, they may prioritise certain populations. The deterrent effect of such prejudice is a rampant issue globally. Suicide rates are also high amongst vulnerable groups who experience discrimination [57]. This points to the critical view of an individual's feeling that he or she belongs in a society. The feeling of belonging is being able to share one's interests with other people, leading to a sense of community. Sense of community is a concept in the field of community psychology, which has been defined as "the sense that one was part of a readily available, mutually supportive network of relationships" [1]. The term 'social innovation' is used to denote finding acceptable solutions to problems of exclusion, deprivation, and lack of well-being. Providing this change means the improvement of social relations—micro relations between individuals and people, but also macro relations between classes and other social groups [10]. This relationship between humans and their environment is emphasised by James J. Gibson's Theory of Affordances [58,59]. This theory implies the complementary relationship of the 'animal' to its environment. He identified three factors that are essential to this relationship. In addition to the structure, the behaviour and the purpose are also determinants of the existence and consequence of behaviour that can manifest [58,59]. Therefore, the tangible aspects of a city must be balanced with meaningful opportunities from which an individual can sustainably function. As such, the design approach given attention in the previous chapters are unquestionably critical to an urban regions' liveability and desirability as a place to live and work.

9. Conclusions

With the aim of shedding light on the benefits of considering neurodivergent environments in creating liveable cities, this paper opens with a literature review of the existing design guidelines [35–38]. These guidelines attend to the physical qualities of ASD-friendly environments in relation to an autistic individual's physiology. Even though environment types and age groups have specific requirements, it had a general view of the individuals. With the rising need to design appropriate living environments for individuals with ASD, documents specific to home and neighbourhood design have eventually developed [14,41]. It advised on (1) how to improve housing services, (2) design responses to the attributes of ASD, and (3) housing, living arrangements and neighbourhood selection.

If housing options are to be readily available, ASD individuals should also be able to sustain it. The sad reality is among people with disabilities, the ASD individuals are the most unemployed and underemployed [8,16,17,20]. The existence of stigma that ASD individuals cannot compete in the industries hinders their access to meaningful opportunities. This suggests that there are other possibilities of approaching ASD-friendly environments, more than what the existing design guidelines imply. With this in view, the proposal is to embrace their individuality that will maximise their potential. This is by considering the value of savant and productive skills in the design of ASD environments.

“Autistic savant” refers to individuals with autism who have extraordinary skills not exhibited by most persons [23]. Despite this natural gift, the majority of adults are unable to use it beyond their schooling years [21]. The fact that they are aware of their difference and they do not have anything to be proud of onsets adult psychiatric problems (i.e., anxiety and depression) [18,27,28]. This paper addressed this issue by outlining the possible articulation of spaces with this in consideration. These are (1) productive respite spaces, (2) spaces as a source of livelihood, and (3) ‘interest–thing’ social spaces. Even though savants are most common in ASD individuals, their cognitive and intellectual ability are factors to how these gifts manifest [21]. Besides the academic capability, daily life and vocational skills are deemed significant to an individual’s road to independence [19,31]. However, the problem is that most therapy centres lack programmes that are specifically designed for adults [20]. Also, the distress which can be caused by work spaces designed for neurotypicals may hinder their success in finding jobs. As a response, featuring simulated workplace environments that opens to the public is encouraged in ASD environments. This allow the ASD individuals to demonstrate how these skills are applied in real–life situations. Thus, the interaction with neurotypicals present an opportunity for ASD individuals to exhibit their potential. The proposed spatial intervention also increases their chances of understanding and adapting to various types of employment situations, including the financial aspects involved.

As mentioned earlier, despite the current residential concepts deviating from an institutional type of environment, there remains an issue of fulfilling independence and social integration. Hence, the following chapter explored the conceptualised framework through housing typologies. The proposed neighbourhood is divided into three zones with varied residential types in accordance with the level of independence and living arrangements of ASD individuals [14]. The categories are as follows: (1) detached bungalow (Zone 1) for independent ASD individuals who prefer to live alone; (2) duplex units (Zone 2) for independent ASD individuals who are comfortable to live with other people; (3) cluster homes (Zone 3) catered for ASD individuals who need support and supervision. Each zone is designed with the proposed spatial interventions (i.e., ‘interest–thing’ spaces and simulation of workplace environments).

The final section deliberates about how the existing recommendations of ASD environments (e.g., clear spatial zoning and quality green spaces) and the proposed spatial interventions (i.e., ‘interest–thing’ spaces and simulation of workplace environments) supplement the framework of an effective city image. This is exemplified through a discussion that aligns ASD–friendly environment concepts with Kevyn Lynch’s *The Image of the City* [9]. The trend of globalisation strains the liveable quality of cities, such as the walkability of streets, sociability of public spaces, access to recreation and nature, the journey to work, assault from urban noise, safety, health, and much more [55]. This expresses the fact that the features of urban regions are critical to its liveability and desirability as a place to live and work. Therefore, it is essential to balance the tangible and intangible aspects of a city. ‘Tangible’ in this paper refers to the quality of the physical environment in relation to the physiology of human beings. ‘Intangible’ is defined as the meaningful opportunities in which individuals can exhibit their capabilities. Primarily, environments constitute the people in it. Being scrutinised because of your difference (e.g., skin colour, facial features, social status, education) hinders the feeling that you belong in a society. This points to the significance of the proposed optimistic approach (i.e., considering the value of savant skills and productive vocational skills) when designing environments for people with ASD.

In summary, the proposed spatial interventions that allows an individual to share his interests cultivates a sense of security that he or she is accepted by the society. Having this feeling is beneficial to the well–being of all individuals—neurodivergents and neurotypicals. The explored design approach of embracing peoples’ individuality hopes to enlighten built environment practitioners in creating spaces that allow different populations to accept the diversity of each. Clearly, the ASD individuals’ demand for the co–existence of tangible and intangible qualities of spaces, bridges the gap between accessibility and spatial experience. To conclude, the participation of neurodivergents in the built

environment can be a strategy employed to enhance the liveability and desirability of a city as a place to live and work.

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Appendix Survey Questionnaire

NEURODIVERGENT THEMED NEIGHBOURHOODS AS STRATEGY TO ENHANCE THE LIVEABILITY OF CITIES

The Blueprint of an Autism Village, its Benefits to Neurotypical Environments

QUESTIONNAIRE

Gender: ☐ Male ☐ Female

Age:

* Note: You can ✓ more than one answer if it is applicable to you. If you are a parent of the ASD individual, please answer the questions on behalf of your child.

1. Who are you?
 - ☐ ASD individual
 - ☐ Parent of an ASD individual
 - ☐ Others (i.e., carer/therapist of an ASD individual)
2. Who are you (referring to the ASD individual) currently living with?
 - ☐ None (Living independently)
 - ☐ Parents and relatives
 - ☐ Co-individuals with ASD
 - ☐ Others (i.e., carer/therapist)
3. Who do you (referring to the ASD individual) like to live with?
 - ☐ None (Live independently)
 - ☐ Parents and relatives
 - ☐ Co-individuals with ASD
 - ☐ Others (i.e., carer/therapist)
4. Living in:
 - ☐ a landed house
 - ☐ a condominium
5. Living in:
 - ☐ single storey
 - ☐ multi-storey
6. If given a choice, do you prefer to live in a:
 - ☐ a landed house
 - ☐ a condominium
7. Do you like your house? ☐ Yes ☐ No (skip no. 7 & jump to no. 8)
8. If yes, which part of your house do you like most?

9. If no, have you done any adjustments to your home to make it more comfortable for you? ☐ Yes
☐ No
10. What do you wish your house could have been? What changes do you want to make in your house?
- _____
- _____
11. If you will have a new home, is there anything in your current home you want it to follow?
- _____
- _____
12. Do you like your neighbourhood? ☐ Yes ☐ No (skip No. 12 & jump to No. 13)
13. If yes, what feature/s of your neighbourhood do you like most?
- _____
- _____
14. If no, why?
- _____
- _____
15. What feature/s do you want your neighbourhood to have? What changes do you want to make in your neighbourhood?
- _____
- _____
16. Your favourite place
- Indoor: _____
- Outdoor: _____
17. Places you do not like
- Indoor: _____
- Outdoor: _____
18. Do you like an environment
- with trees & plants?
 - bright colours or earth tones?
 - that is noisy or quiet?
 - that has natural daylight or artificial light?
 - that is enclosed or open?
 - that is big or small? (please give an example of this)
19. Outdoor activities you enjoy?
20. How do you feel when you are doing this/these activities (e.g., happy, excited etc.)?
21. What are your hobbies and/or special interests?
22. How do you feel when you are doing this/these activities (e.g., happy, excited etc.)?
23. Do you like to meet people who are also autistic?
24. Do you mind living with people who are also autistic?
25. Do you like family gatherings or celebrating events with your family members (i.e., Christmas, birthday etc.)?

26. Do you have/would like to have a pet?
27. Daily mode of travel
- ☐ car
 - ☐ public transportation
 - ☐ cycle
 - ☐ Walking
28. Do you have a daily routine? If yes, what is it?
-

29. Do you work? If yes, what do you do?
-

30. If you will move to a new neighbourhood where do you prefer to stay?

☐ City (i.e., Metro Manila) ☐ Town (i.e., Tagaytay)

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