ENVIRONMENTS BY DESIGN HEALTH, WELLBEING AND PLACE

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Environments by Design: Health, Wellbeing and Place



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INTRODUCTION

Environments by Design: Health, Wellbeing and Place

This proceedings publication is the outcome of the conference *Environments by Design – Health, Wellbeing and Place*, held in December 2021 as a virtual conference. It was coordinated by the research group AMPS, Syracuse University, Northumbria University, The Italian Society for Sociology of Health and Chalmers University of Technology / Center for Healthcare Architecture. The context for the event was the outbreak of COVID-19 and the subsequent lock-down that highlighted the important relationship between health and the spaces we inhabit. The impact it had on spatial activities as simple as commuting or meeting socially in public space are examples of this.

While the multitude of spatial effects evidenced by the pandemic make it tempting to see the concern about health and the spaces we inhabit as new, research and studies focusing health, wellbeing and spatial conditions have a long history pre-dating COVID-19. Seen in this light, the *Environments by Design* conference placed recent experience and responses against a backdrop of previous research into health, wellbeing and environments. Consequently, the conference brought together a diverse set of theorists and practitioners who examined a wide range of interrelated questions and issues from a range of disciplinary perspectives.

Examples of this diversity included analyses of the impact of the built environment on urban health, health related critiques of housing, and the spatial analysis of health facilities. It also included socio-spatial critiques related to ageing, spatial inequalities across communities, and the funding and planning of welfare institutions. Other scholars addressed the importance of socio-cultural factors and design as issues that impact the health and wellbeing of people in various ways. This diversity of approaches was also visible, and embedded, in the thematically-focused sessions that structured the conference such as: Ageing and the Built Environment; Covid 19; Cultures, People, Place; Health and environments; Health facilities; Health, Wellbeing and Buildings; Healthy Cities; History, Colonialism and Health; Health and Housing; Interiors-Exteriors and Health; Mental Health and Designed Environments; Society and Health; Socio-political Built Environments; Technology, Cities, Health, and more.

The papers collected in this publication then, reflect the variegated nature of the conference themes and provide an in-depth exploration of current research related to built environments, health, wellbeing and place. The theoretical, historical and design approaches in each chapter (whether separately or in combination) provide the basis for the presentation of diverse ideas that move current scholarship forward. As evidenced by the politicization of the pandemic, this is more necessary today than ever, now that research competes in a world characterized by a flora of contested facts. It is a world in which we could argue that while there may be no truth, there surely are true facts.

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THE ANALYSIS OF A PAEDIATRIC TREATMENT ENVIRONMENT IN THE CONTEXT OF NURSES' AND COMPANIONS' BEHAVIOURS THROUGH SPACE SYNTAX AND BEHAVIOUR MAPS

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INTRODUCTION

Environmental psychology is a field of research that discusses the interaction between humans and the environment through concepts such as perception, behaviour, and cognition. The main discussion area of this theory is that individuals are exposed to some perceptual and behavioural changes under the influence of environment and that the environment changes as a result of some effects originating from individuals.¹ In this framework, humans and the environment are considered as equivalent phenomena that mutually affect each other. Thus, any built environment should be considered not only as a physical but also as a social phenomenon. While the environment is a concept that shapes both the individuals' behaviours and their relationships with others, it is also a concept that has an impact on the individuals' reactions to the environment.²

However, when individuals are in different environments from the ones, they are familiar with, they develop new behavioural modes as a result of new perceptual processes caused by unexpected experiences. Considering the healthcare environments, especially the paediatric ones have special importance in terms of both the environmental characteristics and the user groups. Because, paediatric treatment environments, where young individuals need to be treated with a special pedagogical approach compared to adults are such settings that should be designed through a *child-centred* approach that considers the child as a holistic being with his/her physical, cognitive, social, and psychological needs.

Therefore, today's paediatric healthcare environments are collective domains where paediatric patients, their companions, nurses, and physicians share simultaneously. In this framework, this study focuses on two groups of users who share a paediatric healthcare environment and are responsible for the one-on-one care of the child. Companions, as well as nurses, are the individuals who use the healthcare environment 24/7. Since they have to share the same domains in the healthcare inpatient units, the environment has different effects due to their various social and psychological requirements. However, according to the literature review, although there are many post-occupancy evaluation studies on the topics such as children's needs in paediatric wards³⁴⁵, physical environmental factors such as noise and temperature, wayfinding problems, etc., the scarcity of studies on children's companions was noticed⁶. Thus, to contribute to the literature regarding companions, a case study was

conducted in a paediatric haematology and oncology inpatient unit in Istanbul. From this perspective, the research questions to be answered in the study were as follows:

- What is the daily behavioural frequency of companions who spend their time in the inpatient unit with their children, compared to nurses?

- Which space(s) do companions use more often in the inpatient unit?

It is hypothesized in the study that the physical conditions of the healthcare environments create significant effects on the behaviours of not only the health professionals but also the companions. So, the mutual interaction between the physical dataset of the healthcare setting and the behavioural datasets of two user groups using the healthcare setting –nurses and companions- is searched.

THEORETICAL BACKGROUND

When the individuals leave the psycho-social environments they are used to, they tend to develop new behavioural modes in the new environment.⁷ According to Stea, these new behavioural modes occur within clusters of interactions. The first is the concept of the *personal space* of the individual that surrounds him like a bubble, and the second is the *territorial cluster* that surrounds the individual with other individuals. Such a nested multi-layered cluster system may also be applied to hospital inpatient services; the *ward* space where different individuals stay together can be considered as a *territorial cluster*, and the hospital inpatient service, which includes many wards can be considered as a *territorial complex*.⁸

In this context, a hospital is considered as a multi-layered and clustered social space where various individuals with different roles and professions interact with each other in a specially equipped physical environment. Paediatric inpatient settings have distinct importance as their users are children who are vulnerable members of society. So, paediatric healthcare environments and inpatient units are of paramount importance, since care should be taken for the physical, social and emotional integrity and wellbeing of the child in every circumstance and environment, according to the Convention on the Rights of the Child⁹.

Prior to the adoption of the Convention on the Rights of the Child, the issue of child-centred design came to the fore in 1959 with the Platt Report. Central Health Services Council convened in London in 1956, a committee was established under the chairmanship of Harry Platt to discuss the well-being and happiness of children in the hospital, and it was decided to make changes in the family-centred design in children's hospitals with the Platt Report¹⁰. With the realization of two important principles regarding children's hospitals, large-scale design changes have been made.¹¹ The first important change was the admission of the mothers of sick children to the hospital as companions, and the second change was the admission of visitors for paediatric patients, and these two changes, along with the spatial arrangements in children's hospitals, caused the daily life in the setting to change gradually.¹²

With the involvement of mothers as the companions, it became a necessity to make important changes not only in the inpatient wards but also in the whole setting, especially for the spaces shared by the inpatients and the companions.¹³ In this context, in this study the diagnosis and treatment processes are considered as stressful periods for not only the patients but also the companions who experience the healing process with their children one-on-one. Therefore, since all the spaces designed for the inpatients are shared spaces with the companions, it is inevitable that the companions will be affected by the physical conditions in the healthcare environment.

Moreover, the physical conditions of the hospital building are not only stressful places for sick individuals and their companions. It can also be said that nurses, who are the healthcare professionals also experience environmental stress on different issues where the building design program is primarily patient-centred.^{14 15} Thus, nurses who have difficult responsibilities such as working long hours and night shifts, also need personal space to meet their needs for rest and being alone, as well as spending time with their colleagues to socialize. The main location where nurses usually work is the nurse station, and it is usually placed in a location where it can monitor almost the entire floor. If the medicine storage and preparation room and the head nurse's room have to be planned separately, these places should also be located adjacent to the station.¹⁶

METHOD OF THE RESEARCH

In the analysis part of the study, a two-staged research method was used which constitutes behavioural mapping and space syntax (Figure 1). In the first stage of the collection of the data, behaviour maps were created through one-hour observation of each group separately to reveal the behavioural frequencies of two groups -companions and nurses- on how they used the inpatient unit and the spatial domains where each group used dominantly. The data obtained in this data collection stage is the user-based data so that the datasets obtained at this stage constitute the dependent variables of the study. In the second stage of the collection of the data, syntactic values; *integration, isovist area, isovist perimeter, compactness, circularity, occlusivity, connectivity,* and *mean depth* values for each space were revealed using the space syntax method, which tests the current state of the space quantitatively. The data obtained in this data collection stage is the place-based data so that the independent variables.



Figure 1. Two-staged methodology

Meanwhile, it may be appropriate to give some information about space syntax theory and its applications. Space syntax is a theory that proposes that the morphological structure of architectural or urban spaces has an impact on people's behaviour. Besides, it is a quantitative method that enables the numerical analysis of the physical characteristics of both architectural and urban spaces¹⁷. According to the Glossary of Space Syntax¹⁸ developed by the University College of London, *integration* is a normalized measure of distance from any space of origin to all others in the system. Additionally, *isovist* is defined as a set of all points visible from a given vantage point in space and with respect to an environment. The shape and size of an isovist is liable to change with position.¹⁹ In the context of isovist parameters, six different criteria were put forward by Benedikt²⁰: *isovist area, isovist perimeter, occlusivity, variance, skewness, and circularity.*

Sampling Groups

By adhering to the above-mentioned theoretical content, the subject of this study is structured as searching the effects of the physical characteristics of a healthcare setting, on the behaviours of the (1) companions, and (2) nurses. The participant group of companions is considered to have a temporary compulsory presence in the setting, while the participant group of nurses is considered to have a

permanent occupational presence in the setting. All of the 30 companions are women; 28 of them are the mothers of the children and 2 of them are the older sisters. Of the 12 nurses participating in the study, 10 are female and 3 are male.

Case Study Setting

The inpatient unit has a single-aisle configuration, and all spaces are accessed through a common corridor (Figure 2). There are twelve paediatric wards where the companions can also stay with their children. A locker area for the nurses, drug storage, and drug preparation room are located adjacent to the nurse station. In addition, there is a doctor's room, a meeting room, a microscope room, and a medical intervention room. In accordance with child-centred design principles, there is a hospital school and a playroom since the treatment of the children in the unit sometimes takes months or even years.



Figure 2. Paediatric Haematology and Oncology Inpatient Unit Floor Plan

RESULTS

As stated in the methodology of the study, the data on the behavioural dataset regarding companions and nurses together with the syntactic dataset revealed through accessibility and isovist graphs, the results obtained and a discussion on the results are given in detail in this section.

Behavioural results

Representation graphics consisting of pixels were created with 60 minutes of behavioural data, which is the observation period of each individual, assuming 1 min. is equal to 1 pixel. The places where each companion and nurse is spending time for one hour are marked on the plan by painting the pixels. So, the total number of places that each companion and nurse changed was recorded as the total spatial behaviour frequency of that companion or the nurse (Figure 3a, Figure 3b).



Figure 3a and 3b. Pixel representations showing behavioural data: an example regarding the companions (on the left), an example regarding the nurses (on the right)



Figure 4. Total frequency value of each space in the setting regarding companions' behaviours

In the context of the behaviours of the companions (Figure 4), the place where the spatial frequency is highest in the kitchen. The kitchen is the place where companions cook and socialize with each other. The second place with the highest frequency is Ward no.9. The reason for this result is that the children participating in the study were randomly chosen from among the children staying in this ward. The third place with the highest frequency is the corridor.



Figure 5. Total frequency value of each space in the setting regarding nurses' behaviours

The place where the nurses use the most is the nurse station (Figure 5). The second most frequently used space by nurses is the drug preparation room located right next to the nurse station. The third and subsequent areas of frequent use are the corridor, the kitchen, and the kitchen balcony. Because even though there is a separate place for nurses' use, there is no separate resting area where they can meet their social needs, have drinks, and eat. For this reason, the kitchen and the adjacent balcony stand out as a sociopetal space that is used jointly with the companions.



Figure 6. Mean frequencies of behaviour of companions and nurses during the observation period

Considering the results obtained from the behaviour maps of the nurses and companions, it is revealed that the highest mean frequency was found in nurses and then in the companions, but the value of the companions was almost equivalent to that of nurses (Figure 6). This result can be considered as an outcome that underlines the fact that the companions are the important actors of the daily life in the inpatient unit, and that the social needs of the companions should also be taken into account in the paediatric healthcare environments.

Syntactic results

As can be observed in the *accessibility graph* (Figure 7) as a result of Syntax 2D analysis, the most *integrated* area in the setting is revealed as the corridor by the colour close to the red hue. Besides, it is noticed that the places with the highest *connectivity* are in the places where the doors are located opposite each other while the bathrooms represented by blue, are the deepest spaces of the layout.



Figure 7. Accessibility graph of the inpatient unit

In terms of visibility, it can be said that the most effective situation for individuals to perceive spaces visually is the absence of any obstacles or availability of the transparent surfaces between spaces. In this inpatient unit, there are windows between all patient wards and the corridor, and the visibility between the playroom and the corridor is provided with a dividing structure separation element where the eye level is completely transparent. So, when the *isovist graph* (Figure 8) of the healthcare is

examined, it can be observed that the area adjacent to the playroom is the most visible area of the layout due to this transparent component.



Figure 8. Isovist graph of the inpatient unit

Statistical results

Two datasets were statistically analysed via regression analyses between the behavioural data of the companions and nurses separately and syntactic data to find any significant correlations using SPSS. Considering the correlations established between nurses' behaviours and syntactic values related to the spaces (Table 1), it was revealed that nurses use the spaces with *high circularity* values more frequently.

- Regarding the nurses, intensive mobility on the corridor can be considered a necessity. Since the responsibility of the nurses is to provide medical interventions, the corridor is used the most.
- This result can also be evaluated as a situation regarding the location of the nurse station on the floor plan because the nurse station is located in a highly central point of the isovist area. Therefore, the spaces integrated with the nurse station have the feature of being at a central point, both functionally and syntactically.

	r²	р	significance
Behaviour frequencies of nurses ; Integration value	0,082	0,606 > 0,05	insignificant
Behaviour frequencies of nurses ; Isovist area value	0,09	0,569 > 0,05	insignificant
Behaviour frequencies of nurses ; Isovist perimeter value	0,254	0,104 > 0,05	insignificant
Behaviour frequencies of nurses ; Compactness value	-0,077	0,626 > 0,05	insignificant
Behaviour frequencies of nurses ; Circularity value		0,023 < 0,05	significant
Behaviour frequencies of nurses ; Occlusivity value	-0,148	0,349 > 0,05	insignificant
Behaviour frequencies of nurses ; Connectivity value	0,07	0,66 > 0,05	insignificant
Behaviour frequencies of nurses ; Mean depth value	-0,16	0,313 > 0,05	insignificant

Table 1. Simple regression correlations between the behaviour frequencies of the nursesand the syntactic values of the spaces

Considering the correlations established between companions' behaviours and syntactic values related to the spaces in the setting (Table 2), it is possible to interpret the results regarding companions in two ways.

• Companions tend to use *shallow* and *unoccluded* spaces, together with spaces where the *isovist area* is more central, and where they feel secure.

• Besides, it can be asserted that the spaces with these syntactic values are already located in central locations on the floor plan.

Because the space that appears at the highest frequency in the behavior maps of the companions is the kitchen space where they cook since they are obliged to do in their daily routines. So, the kitchen, wherever it is placed on the floor plan, is a mandatory space to use frequently for the companions.

	r²	р	significance
behaviour frequencies of the companions; integration value	0,207	0,188 > 0,05	insignificant
behaviour frequencies of the companions; isovist area value	0,323	0,037 < 0,05	significant
behaviour frequencies of the companions; isovist perimeter value	0,513	0,001 < 0,05	significant
behaviour frequencies of the companions; compactness value	-0,4	0,801 > 0,05	insignificant
behaviour frequencies of the companions; circularity value	0,472	0,002 < 0,05	significant
behaviour frequencies of the companions; occlusivity value	-0,328	0,034 < 0,05	significant
behaviour frequencies of the companions; connectivity value	0,22	0,161 > 0,05	insignificant
behaviour frequencies of the companions; mean depth value	-0,308	0,048 < 0,05	significant

 Table 2. Simple regression correlations between the behavioural frequencies of the companions and the syntactic values of the spaces

CONCLUSION

Considering the correlations established between the behavior frequencies of the nurses, it was revealed that there was a significant relationship between the behavior frequencies of the nurses and the circularity value. In this context, the necessity of arranging the nurse station and the toilet, dressing room, medicine preparation room, and some resting places integrated into the nurse station is a result that should be emphasized regarding the spatial programs of the paediatric inpatient units.

Considering the correlations established between the behavioural frequencies of the companions, it was revealed that the companions use the spaces with higher isovist area, isovist perimeter and circularity values of the layout, and low mean depth and occlusivity values at a higher frequency. This result reflects the mobility that companions experience in their daily lives, at least as intensely as nurses. The corridor is observed that it turned into a place for exchanging information with the nurses, communicating with other companions, talking on the phone, and sometimes hosting visitors, due to the necessity of the limited number of visitors in the rooms in terms of the risk of infection. This result can be evaluated as a result that both emphasizes the importance of companions and that the personal space, privacy, and social needs of the companions should be addressed as a priority in paediatric healthcare environments.

NOTES

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BIOPHILIA AND THE CITY: TOWARDS AN URBAN WALK

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INTRODUCTION

Biophilia¹ today offers regenerative potential to address the mental and physical problems that have emerged during the global health emergency. The new post-pandemic world can restart from the extent to which the manipulation of the built environment restores the link with Nature.

Biophilia is a response to the pandemic that generates the image with which it is possible to reformulate anthropic models that effectively restore man's relationship with the Earth's living species. This gaze, which opens up a reflection on the relationship between the pairs of terms mannature and health-territory, must start from biophilia, from the indissoluble deep relationship over thousands of years that man has tightened with life, satisfying physical, psychological and emotional needs in it.

RESTARTING FROM ETHICS

Overcoming the pandemic means, first of all, laying the foundations for a revolution of universal ethical principles. This overcoming requires the construction, over time, of an image so powerful as to orient the whole of humanity away from the egoistic reasoning of which it is the victim; by reworking the first law of human altruism expressed by Garret Hardin in *The Limits of Altruism: an Ecologist's View of Survival*² which identifies the root of a selfish logic int the ethical process of conservation.

Edward O. Wilson analysing a famous sentence by Garrett "Never ask a person to act against his own self-interest"³ observes that the way to safeguard the earth and the species that belong to it is when a mechanism is inserted that leads to individual interest, therefore of a selfish nature. Unveiling an egoistic principle a priori within a conservationist ethic would ensure that an ethical model is set up that is oriented towards the protection of a more important collective good – the preservation of Nature and the earth – by exploiting the perception of individual advantage.⁴

Therefore, "ethical values are constructs that evolve in the human mind through natural selection"⁵ and consequently education to reflect on how to incorporate biophilia into the post-pandemic architecture is about making a connection between species that takes into account that "ethical constructs are learning rules that have evolved genetically because they enhance the survival and reproduction of human beings..."⁶ and it is essential to introduce biophilia into the anthropogenic factor because "it informs us that the balance and mental health of human creatures depends on the existence and health of non-human creatures and wild Nature."⁷

NATURE AS A SHELTER FOR THE SOUL

Covid-19 has caused an increase in mental illness,⁸ contributed to the rise of violence⁹, collapsed the global health system¹⁰ and undermined social relations.¹¹ Is it still conceivable to find a corner of paradise in this world?

In Giuseppe Barbiero's words in *Ecologia affettiva*¹² (Affective Ecology), this is still possible because "in nature, cooperation arises from a truce in competition. If it does not degenerate into the destruction of one of the two contenders, the conflict can evolve into cooperation through certain key steps, consistent with the principles of natural selection that favours the fitness¹³ of the individual."¹⁴

In the book *Introduzione alla biofilia*. La relazione con la Natura tra genetica e psicologia¹⁵ (Introduction to Biophilia. The relationship with Nature between genetics and psychology) the authors Barbiero and Berto, identify that: "biophilia, can be defined as the phylogenetically determined predisposition to human compassion for non-human creatures. Through cognitive mediation, biophilia can evolve into asymmetric empathy for different life forms."¹⁶

This mediation can be found in the prefigured relationship between the human body and the idea of shelter that Joseph Rykwert refers to in the text *On Adam's House in Paradise*¹⁷ since it is configured through a search for psycho-physical well-being that operates in continuity with the man-nature syntax necessary to identify the possible origin of the form of biophilia. Rykwert formalises through the description of the text the necessary condition to imagine what the house for the soul was, the space and the place that, besides being a building in itself, assumes in its formativity, a theorisable model that connects with the internal world – the psyche – and with that of the origins – the corporeality and the earth – starting from the relationship with nature and that, syntactically continues with what is the meaning of biophilia highlighted by Barbiero and Berto determines the archetypical nature of the relationship with things.

The shelter, as described by Rykwert, – physical and psychological – is constructed by means of an ideal order. Rykwert, when re-describing the place of the soul, refers to a precise physical space: "the floor was made of earth, its pillars were living beings, its woven ceiling was like a small sky of flower leaves..."¹⁸ nature is in fact an integral part of the image that serves to define what is "the mediation between the intimate sensations"¹⁹ of the body and the infinite potential of the unknown nature that surrounds man.

NATURE AS A CURE FOR MAN

At this point it becomes legitimate to ask whether architecture can lead us back to our deepest origins and preserve the image projected by Rykwert, offering protection and comfort in a way of inhabiting the earth that operates in continuity with Nature?

Where and when does the possibility of glimpsing the transferability passage that projects an archetypal figure of biophilia from the forms of the earth into architecture begin? Barbiero and Berto explain that "biophilia is fundamentally the expression of psychological phenomena that have their roots in the deepest human history, when interaction with the natural environment found its own balance that is now inscribed in our genes."²⁰

The effect of the generalised lockdown replaced the figure of the active man and protagonist of the city with that of a passive subject and observer, while Nature rapidly regained vital space between the anthropic structures. As evolutionary biologist Menno Schilthuizen explains, Nature has a very rapid ability to adapt to the absence of man, and as botanist Peter Del Tredici points out, occupying empty spaces is an innate opportunistic factor in nature.²¹ Man, who has changed some of the characteristics of his behaviour during confinement, now has the opportunity to reverse the polarised image of an anthropocentric world into a biocentric one, capable of re-establishing a connection between nature and the human being.

The purpose of this inversion should be to put the relationship with the territory back at the centre of man's interests and behavioural habits, projecting and introducing into everyday life new scenarios for a psycho-physical balance between the species and the geographies they inhabit.

The possibility of approaching a different way of thinking, designing and living spaces would initiate a process of restoration of the ecological image of our planet by replacing the model of consumption with a sustainable logic of being in the world, consistent with human history, tradition and the culture of places.

The idea of a plausible image that we can look for in that gaze that does not flee from its origins but seeks continuity in them, which comes through time and things and which re-emerges and is reborn from the forms of the past, is thus unfolding and clarified.

This process should be the result of a thought that is formalised in a coordinated design of preventive and operational actions aimed at restoring the geographical features of the territory in a city whose aim should be to re-establish the biophilic relationship with the original identity of the places.

THE CANNIBALIZATION OF THE EARTH'S CRUST

However, the primordial image of Man, the archetype of a figure related to the origins, in harmony with nature, the sky, the earth, the animals and the rhythm of the biosphere, is thrown into crisis as it becomes fundamental to recognise how the betrayal of the original principles of instancing oneself on earth have been replaced by an idea of inhabiting nature that derives from the speculative logic of profit and power and that, from time to time, has redefined the compromises exercised on the earth's crust.

Barbiero's words are crucial to understanding the scenario towards which Man is projected, because, the biologist continues, "the disappearance of Nature is a question of the ethics of mankind's survival."²² Barbiero continues by asking "How will we replace the services provided by ecosystems? What happens to the human psyche when such a fundamental part of the human evolutionary experience is disappears?"²³

In the essay *Civiltà e territorio*²⁴ (Civility and territory) Saverio Muratori offers an overview of a man who, from the decadence in which he is immersed, perpetually struggles between "the destructive power of self-consciousness..." and "the natural conservative force in the spontaneous consciousness of the species."

These two antagonistic forces reach equilibrium at the moment when man's conservative nature becomes aware of the impact of the destructive force of human activity on the planet by becoming aware of the uncontrollable loss of natural reality; this force is such that it destroys man himself.²⁶

This irreversible bulimic process of cannibalisation of the ground that *Homo Sapiens*, as an ecological agent, has imposed on the planet, is formalised in terms of recognisability when the action carried out by man on the earth's crust is so extensive and irreversible that it becomes fundamental to find a term to define the era of the anthropic factor. Man proclaims himself as the undisputed and unconditional ruler of the laws of nature, defining his era as the era of man: the Anthropocene²⁷.

WALKING IN THE DARK

The anthropocene places the figure of man at the top of the so-called food chain, figuratively corresponding to the "beast" of the past – as Giorgio Agamben observes – who omnipotently scrutinises reality and who, looking back at the past, perceives the vertigo with which man is unable to give way to consciousness in order to listen to nature.²⁸

The current vertigo caused by the pandemic, corresponds to the sense of bewilderment, the search for the dark described by Agamben,²⁹ the estrangement from security which, plunging into the new millennium, initiates a retrospective analysis of the substance of the years gone by and which requires

a revolution for the new coming – the ethical revolution. The new century or millennium, demands in its acerbic ascent to maturity, a condition of distancing themselves from the past, from the roots³⁰ of its own time in order to reaffirm a new identity that, as Agamben describes, corresponds to the fracture that is generated between one century and another, to the lost identity of a time – pre-Covid-19 – that must walk in the darkness of its own time to get used to the absence of light.³¹

If we think about what we have connected in the discourse so far – biophilia, origins, man, nature, ethics, pandemic... – we can immediately realise that projecting ourselves in search of a way of thinking about reality unquestionably starts from a study of the forms of the past and that in the attempt to move away from them, we rediscover during the effort of the ascent – see the myth of Sisyphus by Camus – a plausible origin that brings us closer to the figure of the archè, allowing us to prefigure the shift of the egocentric model that man has introduced as a scenario in the construction of his own daily life towards a biophiliac model that brings man on the same level as other life forms.

TOWARDS A BIOPHILIAC IMAGE

At the origin of these reflections, there is the idea of understanding how we can today measure up to the thought that produced some of the theories considered innovative at the beginning of the last century and that, believing in distancing itself from tradition and its roots, as well as measuring itself with the architectural and urban space, projected onto it scenarios and figures that transformed the image of the city.

According to Agamben, "the contemporary is the one who receives in full face the beam of darkness that comes from his time."³² This assumption leads us to ask in what form does the contemporaneity of a theory reside, and how can architectural design become a biophilic mechanism?

I would start by questioning whether the image of a new biocentric city can take shape from the thinking of the theories developed by the Modern Movement, whose prefigurations projected an anthropomechanical model onto the city, thus participating in the definition of the process of acceleration and alienation³³ of late modernity.

Secondly, I would like to understand whether biophilia, understood in its relationship to life between man and Nature, can help to re-formulate a theory for design.

A new point of view for the Modern Movement

The scientific discoveries of the new century, the new materials, the experiments related to industrial production and the arrival of new means of transport literally made cities explode under the weight of innovation and the desire for change.

In all this, the Modern Movement set itself a horizon to be reached which, in architectural and urban planning terms, aimed to respond to the new post-war housing needs in a universal manner, offering standard solutions valid everywhere.

If the first attempt is on the one hand to find generalisable solutions, on the other hand we know that generalisability operates the elimination of difference and that in this case it represents the factor of biodiversity, effectively removing the value of the geomorphological characters necessary to postulate a theory of design that links with Nature.

However, many projects on the urban and architectural scale offer a reason to reflect on the extent to which the rural conditions surrounding the newly emerging metropolises introduced the theme of biophilia into ideas and projects for housing and the city in fragments.

The projects of the architects of the Modern Movement bring back, in their material and immaterial representation, a content with a nostalgic aesthetic factor: the search for nature, whose intent is to reproduce in the new the element that has generated in the individual experience the factor of psycho-physical well-being that is part of the innate memory in the man's nature.

Despite the fact that the green could somehow appear as a decorative device, the figure of the green is in fact the tangible connection between the architectural project and Gaia, becoming the element of reconciliation with the hypothesis that "each generation corresponds to a specific way of stimulating biophilia."³⁴

Architects such as Wright, Gropius, Mies, Le Corbusier and Aalto experimented not only with architectural features expressing functionality, rationality and aesthetics, but also with research that went beyond the architectural object, contributing to the fact that man's home is to be found in the relationship with nature, and that nature is a verbal instrument of design, because as Calvino intuits "... the eye does not see things but figures of things that see other things..."³⁵

A house is a biophilic device

Le Corbusier's famous phrase: "Une maison est une machine à habiter"³⁶ which has crystallised over time the image of the house-machine, needs to be totally overturned because the house is not a machine but an indissoluble device reflecting man's need to have a relationship with Nature – with the fragments of it. The house and, the sum of houses that become cities, are for man the connection and the relationship with the biosphere, since *Une maison est un dispositif à biophilie*.

TOWARDS A BIOPHILIAC WALK

Aalto's Paimio Sanatorium is a medical device that, together with the MIT Baker House Dormitory (Figure 1) transforms what Barbiero calls "the know-how linked to the relationship with Nature"³⁷ into an architectural instrument which stimulates biophilia. Gropius, when he built his private home in Cabot Cove (Figure 2), demanded that it be immersed in Nature; the rationality of the gesture lies in formalising the way in which it is possible to bring fragments of the outside world into the *Dispositif* à *Biophilie* to heal the soul and the body.



Figure 1. Sketches and drawings by Alvar Aalto

Wright's organic machines build spaces for a cultural transmission of biophilia.

If we look at the designs of the Darwin D. Martin House or the Robie House (Figure 3) we can glimpse that the surrounding environmental conditions transform the natural environment into a pedagogical act: biophilia pervades the architecture offering the user the regenerative capacity to condition the emotions, physical development, reasoning, mental and social health of man.



Figure 2. Pictures of the Gropius House by Thomas Pepino



Figure 3. Drawings by Frank L. Wright and photo by Thomas Pepino

Le Corbusier, whose image as an innovator is encapsulated in the astuteness with which he was able to steal references from the characters and figures of reality and reintroduce them into the world around him,³⁸ never abandoned his intention to build a house for the soul. It is obvious, in my opinion, that he would not have been able to promote himself if he had said: "Mes projets sont des projets pour la nature! Ces projets ne sont pas destinés à l'homme nouveau qui désire la voiture."

If we want to glimpse an eco-logist imprint in the idea that moved a whole generation of architects focused on rebuilding the dwellings of entire parts of the city following the bombings of the First World War, the "invention" of affordable housing, the "Dom-ino" (Domicile and Innovation)³⁹ reminiscent of the game of dominoes, offers a theoretical approach to imagining the new biophilic city. Architecture is partly reduced to assemblage, it becomes possible to play with certain types of forms and, thanks to the possibility of re-populating the land after the disaster of the world war, it helps to theorise a set of factors that lead to the idea of a "cité jardin horizontale" in Pessac (Figure 4). The plausible formalisation of a theory actually begins with the need to construct a condition of well-being through architectural design.

In most of Le Corbusier's projects, we notice how the construction of the scenic apparatus – see Villa Savoye – brings the figure of Nature back to the centre (Figures 5 and 6).



Figure 4. Le Corbusier (Jeanneret, Charles-Edouard 1887-1965), Quartier Modernes Frugès, Pessac, 1924. Encre de Chine sur calque cuir, 100 x 170 cm.© 2022. Adagp Images, Paris, / SCALA, Firenze



Figure 5. Pictures of Maison La Roche by Thomas Pepino



Figure 6. Le Corbusier (Jeanneret, Charles-Edouard 1887-1965), Maisons La Roche-Jeanneret, Paris, 1923. Tirage gélatine sur papier Canson, 49 x 62 cm.© 2022. Adagp Images, Paris, / SCALA, Firenze

One aspect not to be underestimated at this point is, in my opinion, how a Peircian object fits perfectly with the idea that Le Corbusier is a biophiliac. If Peircian theory maintains that the flow of ideas is produced through mental associations of the logical statements that precede it, the construction of a plausible space for man to project himself into the architectural project constantly runs through the experience of the forms of the project. The experience at the Charterhouse of Ema, as Le Corbusier himself says, is among other things, a founding moment to grasp the relationship that architecture establishes between built and natural elements for psychological and physical regeneration.

The Villa Saoye deserves to be decoded on the basis of biophilia, the relationship between nature, man and architecture.

CONCLUSION

This essay crosses the relationship between man and Nature in an interdisciplinary way, searching for a philological connection that builds a plausible archetypal image of biophilia as it evolves over human time. The disciplinary encroachment, although operating within a preordained structure of thought, serves to define the edges of research and reasoning on things.

In the global framework, cities are the breath of evolutionary events and consequently citizens passively undergo behavioural transformations following ecological ones.

The intention of this text is not to find a finished conclusion, but rather to identify within the Modern Movement a possible reasoning on the theme of biophilia, opening a critical reading of the figures and forms that are responsible for codifying in the built environment the relationship between Nature and man, imagining possible scenarios for the debate on biophilia.

NOTES

¹ The term biophilia is first used in a definition by the psychoanalyst Erich Fromm, which defines biophilia as: "the passionate love of life and of all that is alive." See: Erich Fromm, *The Anatomy of Human Destructiveness,* (New York: Holt, Rinehart and Winston, 1973), 365. In 1979, the same term was used by biologist Edward O. Wilson. See: Edward O. Wilson, *New York Times Saturday Review of Books and Art,* vol. 84, 32.

² In my opinion, notwithstanding the fact that 50 years have passed since the reasoning on common goods and the carrying capacity of the planet, Garrett's social philosophy is still coherent with the current state of our society. Man's inability to manage long-term crises – in this case the pandemic – is an obvious ethical inadequacy of making man subordinate to the needs of the planet. Garrett Hardin, *The Limits of Altruism: an Ecologist's View of Survival*, (Bloomington: Indiana University Press, 1977).

³ Garrett J. Hardin, *The Limits of Altruism*, 27.

⁴ Cf. Edward O. Wilson, *Biofilia*, trans. Carla Sborgi, (Prato: Piano B, 2021), 178.

⁵ Giuseppe Barbiero, and Rita Berto, *Introduzione alla biofilia. La relazione con la Natura tra genetica e psicologia* [Introduction to Biophilia. The relationship with Nature between genetics and psychology], (Roma: Carocci, 2016), 30.

⁶ Barbiero, and Berto, Introduzione alla biofilia, 30.

⁷ Barbiero, and Berto, 30-31.

⁸ See: Rodolfo Rossi et al. "COVID-19 Pandemic and Lockdown Measures Impact on Mental Health Among the General Population in Italy," *Frontiers in Psychiatry* 11, no. 790 (2020): 2, accessed January 20, 2022, doi.org/10.3389/fpsyt.2020.00790, and Cao Wenjun et al. "The psychological impact of the COVID-19 epidemic on college students in China," *Psychiatry Research* 287, no. 112934 (2020), 8-10, accessed January 20, 2022, doi.org/10.1016/j.psychres.2020.112934.

⁹ See: Shelby Bourgault, Amber Peterman and Megan O'Donnell, "Violence Against Women and Children During COVID-19—One Year On and 100 Papers In: A Fourth Research Round Up," *Center For Global Development*, https://www.cgdev.org/publication/violence-against-women-and-children-during-covid-19-one-year-and-100-papers-fourth, accessed January 20, 2022.

¹⁰ See: Mara Tognetti, "Come ripensare il sistema sanitario dopo questa pandemia," *Quotidiano Sanità*, January 20, 2022, accessed January 20, 2022, http://www.quotidianosanita.it/studi-e-analisi/articolo.php?articolo_id= 84802&utm_source=dlvr.it&utm_medium=gmybusiness, and OECD/European Union, *Health at a Glance: Europe 2020: State of Health in the EU Cycle*, (Paris: OECD Publishing, 2020), 43-53, https://doi.org/10.1787/82129230-en.

¹¹ See: Amanda Mull, "The Pandemic Has Erased Entire Categories of Friendship: There's a reason you miss the people you didn't even know that well," *The Atlantic*, January 27, 2021, https://www.theatlantic.com/health/archive/2021/01/pandemic-goodbye-casual-friends/617839/.

¹² Giuseppe Barbiero, *Ecologia affettiva. Come trarre benessere fisico e mentale dal contatto con la Natura* [Affective Ecology. How to get physical and mental well-being from contact with Nature], 7th ed. (Milano: Mondadori, 2021).

¹³ The term fitness, as Barbiero himself specifies, means the reproductive success of a given genotype. Specifically, it is understood here as a *conditio sine qua non* post-pandemic, a necessary requirement to rebuild the lost relationship between species, cooperating with the forms of nature.

¹⁴ Barbiero, *Ecologia affettiva*, 82.

¹⁵ Giuseppe Barbiero, and Rita Berto, Introduzione alla biofilia. (Roma: Carocci, 2016).

¹⁶ Barbiero and Berto, 54.

¹⁷ Joseph Rykwert, *La casa di Adamo in Paradiso* [On Adam's House in Paradise], trans. Enrico Filippini and Roberto Lucci, 3rd ed. (Milano: Adelphi, 2005).

¹⁸ Rykwert, *La casa di Adamo in Paradiso*, 217.

¹⁹ Rykwert, 217.

²⁰ Barbiero and Berto, 31.

²¹ Cf. Elena Sommariva, "Umani in quarantena, la natura conquista le città: esercizi di coesistenza," Domus, March 27, 2020, https://www.domusweb.it/it/architettura/gallery/2020/03/27/esercizi-di-coesistenza-umani-in-quarantena -la-natura-conquista-le-citt.html.

²² Barbiero and Berto, 30.

²³ Barbiero and Berto, 30.

²⁴ Saverio Muratori, *Civiltà e territorio* [Civility and territory], (Roma: Centro Studi di Storia Urbanistica, 1967).

²⁵ Muratori, *Civiltà e territorio*, 272-273.

²⁶ Cf. Muratori, 272-273.

²⁷ The term anthropocene was diffused by Paul Crutzen (1933-2021) in 2000 to define, through the use of a neologism coined by Eugene Filmore Stoermer in the '80s, the geological era in which the work of man on the earth's crust has become characteristic for the planet. In the development of this discussion, it represents the outcome of a genealogy of human activity that, starting from the use of the machine as an instrument at its service, identifies the era in which man is *deus ex machina* of the planet. See: *Vocabolario Treccani Online*, s.v. "Antropocene," accessed December 10, 2021, https://www.treccani.it/enciclopedia/antropocene_(Lessico-del-XXI-Secolo)/.

²⁸ Cf. Giorgio Agamben, Che cos'è il contemporaneo?, (Milano: Nottetempo, 2008),10-11.

²⁹ Cf. Agamben, 13.

³⁰ For more information about the meaning of roots and origins, see Maurizio Bettini, *Contro le radici: Tradizione, identità, memoria* (Bologna: Il Mulino, 2012), 11-20.

³¹ Cf. Agamben, 12-13.

³² Agamben, 15.

³³ For further discussion useful in defining social acceleration and alienation, see Hartmut Rosa, *Accelerazione e alienazione. Per una teoria critica del tempo nella tarda modernità* [Alienation and Acceleration. Towards a Critical Theory of Late-Modern Temporality], trans. Elisa Leonzio (Torino: Einaudi, 2015), 15-21, 108-114.
³⁴ Barbiero and Berto, 37.

³⁵ Italo Calvino, *Le città invisibili*, (Torino: Einaudi, 1972), 21.

³⁶ Le Corbusier, Vers une architecture, 1st rev. ed. (Paris: Les Éditions G. Crès et C^{ie}, 1924), 73.

³⁷ Barbiero and Berto, 37

³⁸ On this subject, see Brian B. Taylor's text that points out the possible connections between the system of structures of the Dom-Ino house and the brochures of the American Portland Cement Association for which Le Corbusier worked. See: Brian B. Taylor, *Le Corbusier at Pessac*, (Cambridge: MA., 1972), 15. Many of Le Corbusier's projects reflect travel experiences and everyday objects, the figures he used also reside outside the discipline of architecture, such as the unrepeatable influence of the time of the Transatlantic liners.

³⁹ Pier Vittorio Aureli, "The Dom-Ino Problem: Questioning the Architecture of Domestic Space," *Log.* no. 30 (2014), 153–156. http://www.jstor.org/stable/43631744.

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SPATIAL USE IN SCHOOL SHOOTINGS - NEW WAYS OF LOOKING AT SCHOOL DESIGN

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INTRODUCTION

In 1999, the word *school shooting* was introduced to the public - starting with the rampage shooting at Columbine High School, which was followed by more shootings all around the world. For example, the school shootings in Virginia Tech, U.S (2007), Kajuhajoki, Finland (2008), Sandy Hook, U.S (2012), Parkland, U.S (2018) and Minsk, Russia (2021).

As Larkin¹ acknowledge, school shootings are not a personal revenge on someone who might have harmed or violated the perpetrator, instead it is a revenge directed at the school carried out as a collective revenge, to protect others from being mistreated in school. Or, as one school shooter wrote in his manifesto, 'I didn't just go to a class, I was a part of the whole school (...) I hope other will be treated better after this' (*my translation*). In relation to attacking the institution, the perpetrator also in some cases attack the building it-self, by vandalizing it, shooting at it or trying to set fire.

The occurrence of school shootings provokes not only fear, but also fascination and curiosity, even if they still are extraordinarily rare events.^{2⁻³} Many school districts, politicians and researchers are struggling with the question how can this be prevented? Previous research on approaches to hinder school shootings has two main themes: individuals and securitization. Strategies to detecting risk individuals or risk factors, has mainly been conducted with social strategies, such as anti-bullying programs and different risk assessments. Strategies related to securitization, has mainly focused on the use of CCTV, guards, and access control to keep "bad guys out". However, the problem with securitization is that school shooters rarely comes from outside the school; it is usually a student at the school, so the threat come from the inside.

In contrast to previous research, this paper will not focus on why school shooting occurs – the main objective is to analyze how these attacks are conducted. More specific the perpetrators spatial use will be explored. Hence, by analyzing *how* the perpetrator use stairs, corridors, and classrooms to facilitate the attack, we can find new ways to prevent these shootings or at least find ways to work with harm-reduction.

THEORETICAL NOTES

Since shootings and lethal violence at schools can occur in many forms, this paper defines school shootings as a specific type of violence which⁴

- 1) Take place in a school related public stage
- 2) Involve one or more shooters who were students or former students of the school

3) The attack has multiple victims, even if not all are killed

4) Some victims are shoot due to their symbolic significant and some randomized

Previous research has characterized the "typical" school shooter as a white middle-class adolescent male, living in suburban or rural areas, with no previous known history of law-abiding behavior or academic problems⁵

Newman and her colleagues' highlights in their work, that a school shooting is dependent on five necessary, but not sufficient conditions: subjectively exposure to social marginalization, psychosocial vulnerability, presence of a cultural script, staying under the radar and access to weaponry.⁶ A school shooting therefore intertwine both individual traits, contextual factors, and structural preconditions.

To enable an analysis of the spatial use in school shootings, the theoretical framework needs to acknowledge following aspects in previous research: locations of school shootings, the well-planed act and the presence of a cultural script.

Firstly, location matters in school shootings. In general, school shootings (as defined here) take place in suburban or rural closed-knitted societies, often in schools without any social problems.⁷ These kind of societies is often glorified and portrayed as safe for children and youths, but as it seems they also miss an "exit" for youths that do not feel like they fit in. According to previous research, school shooters often describe themselves as outsiders, due to music taste, philosophy or likewise, , and these close-knitted societies are often embracing traditional ideals, which amplifies the feeling of being outside.⁸

Secondly, these acts are not carried out on impulse; the perpetrator has planned the attack carefully, between couples of weeks to years. In the planning phase, some elements are of importance, such as the "performance of the attack", how to send a message to the world and to find date for the attack.⁹ Due to the planning, information regarding the plan has often "leaked" before the attack. This information leakage or informational clues can be either implicit or explicit, in different forms – all from writings in school toilets, verbal threats to online-comments in different Internet forums. However, the leakage are rarely detected and/or act upon, hence these signals are weak and sometimes hard to distinguish from normal ambivalent behavior of an ordinary adolescent.

Thirdly, as a part of the performance, the cultural script, becomes of importance. The cultural script, can be described as a 'blue-print' of performance in school shootings, including style of clothes, how to perform and having a manifesto. In other words, the school shooter is on a stage following a manuscript.¹⁰ These scripts, however, differ between different shooters since they combine elements from popular cultural and refers to anti-heroes (such as former school shooters, terrorist etc.).¹¹

These three theoretical notions, location, planning and occurrence of a cultural script, in combination with Collins work on violent encounters¹², will be used in the analysis, to explore the spatial use in school shootings. As Collins argue, violence goes against human physiological hardwiring, and is an exception not a rule in interactions, but to conduct violent acts we are depending on emotional energy.¹³Emotional energy, is not a specific emotion, but instead an amount of emotional power, that makes it possible to dominate a situation.

MATERIAL AND METHOD

Due to the explorative character of the study, a small comparative case study will be conducted based in previous collected data from five school shootings occurred between 2002 and 2011, conducted in U.S (n=2), Europe (n=2) and South America (n=1). The inclusion criteria of these five shootings were that either the police reports, witness reports or visual data (such as CCTV) addressing the perpetrators movement during the attack. Thereto, the data needed to have a layout from the school, enabling a mapping of the perpetrators movement in the schoolhouse. The study object can therefore be defined as a convenience sample, but the sample still include a maximum variation in relation to age of perpetrators, geographical location and schools.

Case number	Location	Perpetrator	Dead and injured
1	April 26:th 2002	Robert Steinhäuser, 19	16 deaths $(+1)$
	Gutenberg-Gymnasium, Erfurt,	Expelled student	1 injured
	Germany		
2	April 16:th, 2007	Seung- Hui Cho, 23	32 deaths (+1)
	Virginia Tech, Blacksburg Virginia,	Student	23 injured
	U.S		
3	November 7:th, 2007	Pekka-Eric Auvinen,	8 deaths (+1)
	Jokela High School, Tusby, Finland	18	12 injured
		Student	
4	February 14:th, 2008	Steven Kazmiersczak,	5 deaths (+1)
	Northern Illonios University, De Kalb,	27	21 injured
	Illinois, U.S	Former student	
5	April 7:th, 2011	Wellington Menezes de	12 deaths (+1)
	Tasso de Silviera Municipal School,	Oliviera, 23	22 injured
	Realengo, Rio de Janerio, Brazil	Former student	

Table 1.Selected cases, (+1) signifies that the perpetrator committed suicide or was killed in relation to the attack.

As seen in Table 1, all perpetrators in the selected case was male, between the age of 18 and 27. Two were students at the school during the attack, one was expelled from the school and two was a former student. One attack took place at an elementary school, two at high schools and two at universities. In total, the attacks claimed 73 deaths and 79 injured. In addition, all perpetrators died in relation to the attack.

The collected material was analyzed qualitative by within- and cross case analysis,¹⁴ with a focus on the perpetrators movement in the schoolhouse. Each case was first analyzed in relation to how the perpetrator entered the school, which rooms, corridors etcetera was used in the attack and how the spatial layout facilitated or hindered the attack. Thereafter the patterns in the cases was compared with each other to find common elements in the attacks.

RESULT AND DISCUSSION

In the result section, I will first present a description of the attack related to the perpetrators movement in the building. Thereafter, three identified facilitators in the attack, namely: orientation, control and target rich environment will be presented, followed by a brief discussion related to age-difference in spatial use. Finally, a discussion related to preventive implications of the result will be done.

Mapping the attack

By mapping the attacks in the school building, each case got a specific pattern and it was possible to identify the movement in, around and in some cases out from the school building.¹⁵

The perpetrator in case no. 1, first went to the lavatory next to the entrance on the ground floor to change clothes and unpack his weapon, thereafter he went in to the west corridor and started shooting in the secretary, before he went to the first floor by west staircase and shoot the teachers in room 105 and 106. Thereafter he went up to the second floor, visited room 205 and 206, went thru the corridor to room 208 and 211, before he entered the west staircase and went up to the third floor and fired his

gun in room 304, 307, and 311, he crossed the stairwell and went down the south staircase to room 208. Next, he went down to the ground floor, leaving the building and went to the schoolyard before he went in again and went up to room 111, where he also committed suicide.

Case no. 2, took place a classroom building at Virginia Tech campus, Norris Hall, where the perpetrator chained all three different exit doors, before he went upstairs to the second floor to perform his attack. He walked in the corridor, shooting multiple times in four different classrooms and the stairwell. He committed suicide in room 211, after the police breached the doors to Norris Hall.

In case no. 3, the perpetrator entered the school building by the main entrance and started shooting in the corridor next to it, moving to the lavatories further down the corridor. Thereafter went up to the first floor, shooting at the canteen (which was locked), before he went down again and entered the schoolyard instead. After firing his gun on the schoolyard, he went back into the school, using the staircase and entered a classroom at the first floor, after that he entered the corridor and moved to the lavatory next to the canteen and committed suicide.

In case no. 4, the shooting took place in a single lecture hall, room 101, where the perpetrator entered the building thru the main entrance and kicked up the door near the lecture hall stage, and pulled out his weapon and started shooting at the auditory up front.

In case no. 5, the school had a receptionist, which asked for his errand in the school. The perpetrator explained that he was going to get some old school records and he was allowed to enter the school. He went up to the second floor, using the stairs, and entered a classroom, telling the pupils that he was a substitute, and started firing his gun. After that, he went back to the stairs, and started to walk up to the third floor, but got shoot by the police in the staircase.

All schools in the sample here, are rather large buildings, and can be understood as target-rich environments (many potential victims). For example, case no. 1 has five floors and room for 750 pupils, case no. 3 is a school center, combining middle- and high school facilities in a three-floor building, designed as the letter P (a square with an extra corridor) and case no. 5 took place in a squared formed building with three floors. In addition, in all cases the perpetrators entered the school building thru the main entrance on the ground floor. Which also was the starting point for three of five attacks, only two attacks started on another floor in the building, stressing that the entrance and first floor are more vulnerable for these kind of attacks, compared with the rest of the building.

Differences in spatial use

There is, however, a notable difference between the attacks. Two perpetrators was moving around extensively in the building (case no. 1 and 3). The other three, case no. 2, 4 and 5, instead performed the attack in a smaller area in the building, where they "trapped" there victims in a smaller area (such one classroom or part of the building).

Case no. 1 and no. 3, are covering an extensive area of the school, similar to how attacks are performed in game-situations (such as Counterstrike or similar firs person shooter games). The attacker are constantly on the move, systematic searching a building for victims. In case no. 1 the perpetrator was on 10 different unique places, using the west and south wing to facilitate his movement in three different floors the building and outside. Case no. 3, had almost the same approach, moving between nine unique places, on two different floors inside and outside the building. This can be described as a systematic approach, by not only systematically moving around to find potential victims, but also systematical move around to avoid/confuse the police.

In contrast to moving around, case nos. 2, 4 and 5, were more concentrated to one or a few places in the building, trying to cut of the victims' possibilities to escape by controlling a smaller area. This is especially notable in case 2 and case 4 and these attacks can be labelled as strategic. In addition, in

case no. 5, it is unclear if the perpetrator would move around further in the building, but the attack can be described as strategic. Mainly since the perpetrator created "legal" reason of his visit to school (getting old record), and in the classroom (being a substitute).

This variation might be due to the cultural script, or the blueprint of the attack. In the cultural script, the perpetrator finds clue of the performance of the attack, and the cultural script is often connected to choice of clothes, weapons, and etcetera.¹⁶ Nevertheless, it might also has a spatial message in terms of *how* to conduct the attack and stressing different aspects of the shooters desire to control space.

Controlling space

Regardless if the attack was systematic or strategic, the shooters controlled space by using the spatial logic of the building. Such as moving thru corridors to "control" the room, taking advantages of the proximity between stairwells-classroom, classroom-classroom and corridor-functions (such as lavatories, secretary or canteen). The layout seems to facilitate the attack, and by being a student or former student in the school – the perpetrator take advantage of the knowledge of how the schoolhouse can be used to fulfill the purpose of the attack.

In a systematic attack, the perpetrator orient himself easily thru the building, controlling a large area, and have the upper hand compared to the police, whom can have trouble locating the active shooter. Thereto, a moving shooter can complicate the schools response to the attack, to either evacuate, lock-in or lock-down. In the strategic shootings, a smaller area is controlled by cut-off a lecture hall or a smaller building, which gives an advantage in controlling the space instead of being controlled, which makes it possible carry out a fast, explosive attack.

Implications for prevention

In line with previous research, localization seems to matter, especially in relation to the school function in terms of educational level and size of the schoolhouse, creating a target-rich environment. A university needs to be centralized to an area and make room for many students, and schools located in suburban, sub-rural and rural areas also needs to make room for a lot of student to be economic effective. In addition, previous research stresses that these areas having an increased risk for school shooting, mainly due to the lack of exits for adolescences whom feel like outsiders or feel mistreated in school.¹⁷ At the same time, these types of buildings also gives the opportunity to the perpetrator to controlling space.

Moreover, by highlighting the use of the spatial and that movement in school are not randomized, but instead either systematic or strategic, it open ups for two different preventive approaches. Firstly, the first floor vulnerability and secondly, localization and proximity between functions.

As seen here, the attacker are filled with emotional energy,¹⁸ and starts the attack quite directly after entering the school, and by reducing that energy and making it harder to reach stairwells or classrooms, there is a possibility that the perpetrator lose the energy.

In relation to systematic shooters, whom "cut-of" one section, it is important to think of which functions should be located at ground floor and easy to access. In relation to systematic shooters, the use of proximity can be harder, if the school layout has a more integrated mix of functions (such as stair-store-classroom).

However, the most important finding in the analyze is the necessity to design schoolhouses that can facilitate harm reduction in terms of easily evacuate the building, go into lock-down or lock-out. As seen in these attacks analyzed here, in many cases the students was forced to meet the perpetrator in attempts to evacuate the building. How to do this in praxis, stresses the necessity of designer

dialogues¹⁹ since the harm reductive strategy intersect both building, juridical and organizational matters.

Due to the explorative approach and the small sample analyzed here, this paper should be seen as a first step to work with design as a preventive approach against school shootings. The results shows that there is a potential to in-depth study the perpetrators movement and start to more throughout study the use of spatial factors in school shootings, or in other word – how the schoolhouse can be a facilitator, not only due to the symbolic relevance, but also design wise.

NOTES

¹ Ralph W. Larkin, "The Columbine legacy: Rampage shootings as political acts," American Behavioral Scientist 52 no 9 (2009):1309.

² Michael Rocque and Grant Duwe, "Rampage shootings: an historical, empirical, and theoretical overview," Curr Opin Psychol 19 (2018):28.

³ Sara Knox, "Random School Shootings, Teen Culture and the Representation of Violence," in *Rethinking School Violence*, ed. Sue Saltmarsh et al. (London: Palgrave Macmillan, 2012), 149.

⁴ Katherine Newman and Cybelle Fox, "Repeat Tragedy: Rampage Shootings in American High Schools and College Settings, 2002–2008," American Behavioral Scientist 52 no. 9 (2009): 1286

⁵ Katherine S Newman, Cybelle Fox, David J. Harding, Jal Metha and Wendy Roth, Rampage: *The Social Roots of School Shootings* (New York: Basic Books, 2004), 10.

⁶ Newman et al., *The Social Roots of School Shootings*, 235-260.

⁷ Newman et al., *The Social Roots of School Shootings*, 261.

⁸ Sven-Åke Lindgren and Charlotta Thodelius. "School shootings in Seven Countries: Testing and Developing the Theory of Five Necessary Conditions," in *Den motspänstiga akademikern. Festskrift till Ingrid Sahlin [The Recalcitrant Academician. Festschrift to Ingrid Sahlin]*, ed. Björn Andersson et al. (Malmö: Egilaté, 2017), 361.

⁹ Newman et al., *The Social Roots of School Shootings*, 77.

¹⁰ Newman et al., *The Social Roots of School Shootings*, 153, 245, 253.

¹¹ Lindgren and Thodelius, "School shootings in Seven Countries", 358.

¹² Randall Collins, Violence: A Micro-Sociological Theory (Princeton: Princeton University Press, 2008).

¹³ Collins, Violence, 205.

¹⁴ Robert K. Yin, Case Study Research: Design and Methods (Los Angeles: Sage, 2014).

¹⁵ Note that the material used in this study was collected for a previous study and are described Lindgren and Thodelius, "School shootings in Seven Countries", 357.

¹⁶ Newman et al., *The Social Roots of School Shootings*, 245, 253.

¹⁷ Jessie Klein, *The Bully Society: School Shootings and the Crisis of Bullying in America's Schools.* (New York: New York University Press, 2012).

¹⁸ Collins, *Violence*, 94, 360.

¹⁹ Peter Fröst, *Designdialoger i Tidiga Skeden*. (Gothenburg: Chalmers University of Technology, 2004)

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RETHINKING THE WELL-BEING FRAMEWORK IN THE CURRENT SCENARIO

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INTRODUCTION

Well-being can be defined as the positive state of mind and body in relation to the complex system of interconnected components that build up living. Recently Minucciani and Saglar Onay (2018) developed a framework to define these components that include contextual, functional, psychological, social, sensory, aesthetic and ergonomic requirements, which are always in relation to each other and depend on cultural context. In recent research the role of these requirements in living environments has already been investigated with surveys run in different cultural contexts.

Given the recent disciplinary contamination between architecture and neurosciences, implying a strong relation between brain, environment and behavior, emerges the need for a further requirement, which can be called emotional requirement focusing on neurophysiological aspects. Thus, unconscious responses to environment are to be considered, being as important as the conscious ones. This paper aims to rethink the framework underlining the importance of scientific research especially at the intersection of architecture, design, medical sciences and social sciences.

WELL-BEING AND SPACE

Architecture for well-being is a difficult challenge to achieve. Today we know that well-being is an inner state of humans, which can only be reported but not concretely measured. But the same thing also applies for space. Interpretations of space and architecture are related to human nature. Also following the very complex openings that architecture has in this period with regard to humanities, it has to be particularly underlined that space is always "emotional", and it is never "neutral".

If we consider definitions of well-being we come across two main understandings, which concern the eudaimonic and hedonic traditions. The hedonic tradition gives importance to constructs such as happiness, positive affect, low negative affect, and satisfaction with life¹ covering also the studies under the name of Subjective Well-Being (SWB)² mostly referring to pleasure and satisfaction.³ On the other hand the eudaimonic tradition concentrates on the positive psychological functioning, human development ⁴ and self-realization where well-being is seen as the full functioning of the person ⁵ extending far back to Aristo and to the concept of "daimon" or true-self as the realization of which represents the greatest fulfillment in living of which each is capable.⁶ This second perspective is particularly concerned with living well and actualizing one's human potentials.⁷ However, despite the differences in approach, most researchers now believe that well-being is a multi-dimensional construct.⁸ The science of 'subjective well-being' suggests that as well as experiencing good feelings,

people need a sense of individual vitality to undertake activities which are meaningful, engaging, and which make them feel competent and autonomous; a stock of inner resources to help them cope when things go wrong and to be resilient to changes beyond their immediate control.⁹ Moreover there exists also a material consideration of well-being and living standards.¹⁰ Consequently, the diversity of dimensions potentially connected to well-being has also created a confusing and contradictory research base.

Today many researchers have also concentrated on the role of environment and spatial design on wellbeing. It is obvious that space is the container of our lives and nothing about human live and experience can be considered independent from space. Therefore, it is important to establish the concept of well-being in relation to spatial design. In this perspective, well-being can be understood as a combination of hedonic and eudaimonic traditions. Regarding the importance of design from the perspective of both traditions, design can create the right tools with which a person can develop himself and find the right ways to perform his actions for his specific contribution and design can also promote pleasurable experiences and block undesired experiences. Designed objects have the potential to change our interaction with our surroundings in physical, social and psychological levels. Our perceptions, emotions, experiences and their outcomes play an important role on our happiness and satisfaction. A real concept of well-being cannot be established without a broader and deeper understanding of human space interaction. On the other hand, it is also important to accept that the nature of well-being has many other dimensions like the genetically determined happiness set point¹¹ and other life circumstances (e.g. factors such as income, marital status, or religiosity) that cannot be controlled by the environment. Positive cognitive, behavioral, and goal-based activities can be enriched by the environment we live in and according to Lyubomirsky, Sheldon, and Schkade (2005) these activities have the potential to account for a significant portion (up to 40%) of individual differences in well-being.

The Well-being Framework for Interiors

The well-being framework for interiors can be used both as an evaluation method for existing environments and a roadmap for designing new living environments that can promote well-being. The structure of the framework is based on contextual, functional, psychological, social, sensory, aesthetic and ergonomic requirements, which are always in relation to each other (Saglar Onay, Minucciani, 2018; Minucciani, Saglar Onay, 2020). Connection to context has an important role as the factor that makes every interior unique with its location and relationship to the rest of the world. Functional requirements are concerned with creating spatial solutions that support human activities. Psychological requirements are more indirect as they deal with the outcomes of the interaction between human and space. Social requirements deal with the spatial opportunities for the level of interaction between people. Sensory requirements are concerned with both quantitative factors like heating, illumination, acoustics, sound control etc. and their reflections on human senses. Aesthetic requirements are also important as they refer to the integrity and harmony of all spatial elements that can be pleasing to human senses and can promote well-being. Ergonomic requirements are more concrete and they refer to the relationship between all interior components and human body and capabilities (Figure 1). These requirements and the framework in general differentiate from other studies especially with its focus on interiors and human needs. The requirements are also different than the general requirements of design for well-being as they are strongly connected to space and context. Therefore, the well-being framework for interiors aims to define the spatial dimensions of well-being in order to evaluate the importance of every spatial aspect that has an impact on our wellbeing related to interior space.

On the other hand, the framework does not attempt to isolate these requirements from each other as they are always in relation to each other and they are always subject to change in relation to the dynamics of everyday life.



Figure 1. Well-being Framework for Interiors (Saglar Onay, Minucciani, 2018).

In the recent years the framework has been applied to many researches in order the understand if there is a hierarchy between these requirements and if they differ with age, gender and occupation as well as the priorities of different interior environments such as home and school environments. Results always showed the strong effect of cultural differences as more important than other variables such as age and gender.

As stated above it has become necessary to rethink the framework considering the existence of recent contaminations with other disciplines. The spread of the Coronavirus has also become a threshold for the concept of health and well-being as it has underlined the importance of spatial attributes in coping with particular problems, which can unexpectedly come to scene: the collective dimension of individual lives and choices has become even more evident, as well as the political directions given to the spatial dimension of our lives have influenced our perceptions of well-being.

Rethinking the Framework

As mentioned before space can be a promoter of well-being and all spatial components can have a potential to enrich human experience. We as architects deal with space and naturally our ways of thinking are connected to space. On the other hand, in the interaction between human and space there are still many unknowns. Space always communicates and creates emotions even when we are not aware of it. Space guides us continuously changing the way we act and we feel. Peter Zumthor suggests that we perceive atmospheres through our emotional sensibility, a form of perception that works incredibly quickly, and which we humans evidently need to help us survive. He discusses that we are mentally and emotionally affected by works of art before we understand them, or we may not understand them intellectually at all. So we tend to produce an immediate emotional response to all spatial environments that we are immersed in. Similarly, Pallasma (2016) argues that our innate capacity to grasp comprehensive atmospheres and moods is akin to our capacity of imaginatively projecting the emotively suggestive settings of an entire novel, as we read it (Figure 2). When reading

a great novel, we keep constructing all the settings and situations of the story at the suggestion of the words of the author, and we move effortlessly and seamlessly from one setting to the next, as if they pre-existed as physical realities prior to our act of reading.



Figure 2. Church of the Light by Tadao Ando, Osaka; Chapel of St Benedict by Peter Zumthor, Switzerland; St Vitus Cathedral, Prague. The same religious function evokes in these architectures different atmospheres, in each case engaging and clearly favouring certain states of mind.

Pallasma also discusses that we have traditionally underestimated the roles and cognitive capacities of emotions in comparison with our conceptual, intellectual and verbal understanding. Yet, emotional reactions are often the most comprehensive and synthetic judgments that we can produce, although we are hardly able to identify the constituents of these assessments. Mark Johnson (2007) assigns to emotions a crucial role in thinking: there is no cognition without emotion, even though we are often unaware of the emotional aspects of our thinking. In his view, emotions are the source of primordial meaning: emotions are not second-rate cognitions; rather they are affective patterns of our encounter with our world, by which we take the meaning of things at a primordial level. In this perspective in our experience of space, emotions might have the leading role of structuring all the information gathered by our body and senses and therefore as stated by Zumthor atmosphere is perceived so quickly as a form of meaningful exchange (Figure 3).



Figure 3. Therme Vals, (Zumthor, Sigrid, Hâeláene, 2007).

Today we know that unconscious responses to the environments can play an important role on emotions and well-being. At this point emerges neuroscience that can help to understand how our bodies respond to environmental input.

Well-being studies have been under the domain of social sciences for a long time. But today many other disciplines started to get involved in well-being studies, as it is clearly understood that social sciences alone cannot lead us to a comprehensive understanding of well-being. It becomes important to investigate this complex issue through the lenses of other disciplines, which can provide measurable scientific data that can be interpreted to understand the multifaceted nature of human space interaction. Neuroscience becomes an important tool for well-being studies because of its potential to reveal the underlying issues in human space interaction. Neuroscience known as the brain science studies the structure of the nervous system, and related cognitive processes, which are strongly connected to our spatial experiences.

Many studies indicate that qualities of architecture have an impact on our mood, cognitive functioning, behavior, and mental health. Some of these studies focus on the role of nature such as the architectural imitation of natural elements which can lead to the autonomous and quick onset of positive reactions and which can lead to positively toned feelings and stress reduction.¹² Some work focus on the importance of contextual ties and urban connections underlining the access to urban spaces of different types and for varying purposes which has shown to be of great importance for well-being connected to the feelings of safety, security, and belonging.¹³ Providing insight and guidance for designing environments that improve well-being has also been an important field of research.¹⁴ And this evidence creates a strong interest in the intersection of neuroscience and architecture. Scientists have begun to accumulate data on how our brains process buildings and navigate spaces, by monitoring brain activity or even using virtual reality environments.¹⁵ Leading thinkers from architecture and other disciplines, including neuroscience, cognitive science, psychiatry, and philosophy, started exploring what architecture and neuroscience can learn from each other ¹⁶ trying the figure out how human (architect) brain can change the environment and ¹⁷ how architectural design can change our brain and our behavior.¹⁸ However according to Coburn, Vartanian and Chatterjee relatively little work has been conducted on the neuroscience of architecture. They discuss that the goal of such interdisciplinary approaches to architecture is to motivate construction of environments that would contribute to peoples' flourishing in behavior, health, and well-being. They suggest that this nascent field of neuroarchitecture is at a pivotal point in which neuroscience and architecture are poised to extend to a neuroscience of architecture and in such a research program, architectural experiences themselves are the target of neuroscientific inquiry.

So, the question is can we also learn from the responses that our bodies give to our environments? And how can we interpret the various responses our bodies generate through spatial experience? At this point the evidence-base for the neurophysiological impact from environmental enrichment is to be widely examined.¹⁹ According to Bower, Tucker and Enticott, currently there is no standard, accepted, cross-validated protocol or methodology for evaluating how design of built environments affects neurophysiological correlates of emotion in humans. They discuss that if the impact of design characteristics can be understood on a neurophysiological level, this opens the door to understanding if we can support mental health and well-being (in both healthy and clinical populations) non-invasively through environmental exposure as a recognized form of therapy.



Figure 4. The update for the Well-being Framework for Interiors.

So, regarding the well-being framework and the involvement of human body in space it becomes necessary to think about another requirement focusing on the human factor and most specifically emotions that are generated by spatial aspects. We can call these aspects "emotional requirements" at the meeting point of space and human nervous system (Figure 4). As we know that there is a connection between neurophysiological measures and emotions, these bodily responses can be used as a source of feedback for all other spatial requirements. These measures include certain responses of the body including brain waves, respiration rate, hearth rate, muscle tension etc. While space generates certain neurophysiological changes in our body, in fact emotions change. So this requirement concerns the bodily responses to spatial variables, measurable with neurophysiological measures. At this point the consideration of these aspects arises as a further requirement to be deeply studied.

Today we know that emotion plays an important role in our mental and physical health.²⁰ On the other hand, only a small number of studies have been conducted that investigate how design characteristics of the built environment effect the neurophysiological systems linked to emotion processing.

Emotions are often conceptualized as fleeting and most imaging and psychophysiological studies of emotion focus on transient responses to punctate emotional challenges. However, there is growing evidence that emotions can have lingering consequences for cognition and behavior.²¹ Emotional stimuli have been shown to elicit increased perceptual processing and attention allocation.²² There is also abundant evidence that emotionally salient cues strongly influence attention and the ability to selectively respond to relevant aspects of the environment while inhibiting potential sources of distraction and competing courses of action.²³ So, the ability to selectively perceive items in the environment is related to their emotional content.²⁴ Moreover, the rapid and efficient selection of emotionally salient or goal-relevant stimuli in the environment is crucial for flexible and adaptive behaviors.²⁵ According to Okon-Singer and others emotional cues, emotional states, and emotional traits can strongly influence key elements of on-going information processing, including selective attention, working memory, and cognitive control. And at this point it is also important to underline that these aspects are directly connected to human experience related to space including spatial perception, cognition and appreciation.

CONCLUSION

The coronavirus has underlined the importance of interdisciplinary scientific research especially at the intersection of environmental design, medical sciences and social sciences. Human well-being is a multifaceted construct that cannot be accurately measured, but it can be systematically analysed through human experience. The well-being framework gives the possibility to consider all aspects that are connected to human experience in relation to space. All these contextual, social, functional, psychological, aesthetic, ergonomic, sensorial and emotional aspects have an impact on our well-being. The last one defined as emotional requirement has an added value in respect to others because of its potential to give feedback on human space interaction by means of neurophysiological measures.

We as architects focus on space to be appreciated by people, to ease their activities, to give meaning to living environments and to enrich spatial experience leading to continuous emotion processing and related bodily responses. Interpreting these bodily responses and understanding their connections with certain spatial attributes and with atmosphere as a holistic entity can lead to a new understanding of spatial design in relation to human nature and well-being.

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USING HUMAN IN THE LOOP AI SOCIOECOLOGICAL MODELING FOR GUIDING INFECTION PREVENTION THROUGH DESIGN RESILIENCE

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INTRODUCTION

Evaluating information relevant to regional patient catchment area data is expected in conducting design programming for safety-critical healthcare facilities. However, the progression of both hospital and community-onset infections due to antibiotic-resistant bacteria requires the adoption of more adaptive methods for evaluating "outside design basis" factors impact on infectivity risks internal to the healthcare environment. Research supports that infection by certain virulent multidrug-resistant organisms may originate within the community and then spread when brought into the healthcare environments by patients needing treatment. Emerging studies also suggest that several elements of an environment of care's building and equipment design can efficiently serve as vectors in transmitting dangerous microbes to human occupants. Thus, evaluating how particular types of socioecological risk factors within a health system's patient catchment area and how hospital design features like layout, fixtures, and fomites may impact pathogen spread is essential in developing reliable infection control strategies. The following discusses how Human in the Loop (HITL) Artificial Intelligence (AI) may complement Architectural and Design Programming and planning for healthcare environments. It describes how this approach can be used to forecast probability levels of Hospital Acquired Infection (HAI) risk events in specific regional contexts using domain agnostic Socioecological Modeling and evaluating design intervention resilience for moderating pathogen spread in care environments.

SOCIOECOLOGICAL MODEL GUIDED PROGRAMMING

Infection prevention in healthcare settings is a multi-faceted issue impacted by patient acuity, human factors, and engineered systems.^{1,2} Antimicrobial-resistant (AMR) pathogens can frequently cause nosocomial conditions in acute care inpatient settings.³ These specific pathogens have demonstrated the ability to reside in healthcare environments for extended lengths of time. ^{4,5} and are transmitted easily from an environmental surface to clinical caregivers and thus to vulnerable patients.^{6,7,8} Prolonged and direct exposure to these pathogens has led to increased infection contraction by immunocompromised or susceptible patients.^{9,10,11}

Evidence suggests that HAI prevalence within U.S.-based health facilities may be related to regional characteristics such as community infrastructure and demographic factors.^{12,13} For example, HAI is associated with more severe mortality and morbidity in older populations of patients in acute inpatient

care. ^{14,15} Additionally, a patient population's frequency of emergency department visits and use is associated with increased CDI incidences.¹⁶ Enhanced surveillance of HAI-causing pathogen infection incident rates has also manifested relationships between the occurrence of certain types of HAI and localized factors such as exposure to agricultural waste streams in rural areas.^{17,18} The propensity for unplanned population density in urban areas and a deficit of healthcare access to preventative medical care are also examples of contextual conditions contributing to infection virulence.¹⁹

Socioecological frameworks were initially developed for understanding human activity systems in the 1970s and later formalized as a theory in the 1980s.²⁰ They are typically comprised of biological, natural, and built environment elements, societal, economic, and technological systems within a community which is often dependent on the resilience of their interdependent dynamics.²¹ Socioecological models used for public health improvement emphasize relevant environmental and sociological influences on community wellness and wellbeing.²²



Figure 1. Socioecological Model regional categories for HAI prediction

Architectural or Design Programming is a multi-stage activity that establishes building project goals and objectives. It includes gathering relevant information of space context, identifying strategies for operational success, determining component requirements, and summarizing critical baselines for guiding planning and construction efforts.²³ This process occurs prior to the conceptual development of building planning and design and is used as a decision-guiding process based on the built environment's scope of work and function. This feedforward approach identifies the practical requirements of a building's design in terms of its environmental context, intervention inputs, and objective operational outputs.²⁴

Systems in volatile environments such as healthcare must self-adapt to changing circumstances violating some requirements satisfied at initial design inception.²⁵ Many environments built to support safety-critical industries such as healthcare often do not fulfill their operational lifecycle requirements because of failures in their design to meet evolving use demands.²⁶ Dynamic problems such as regional infectivity have vague and mutable circumstances which are not easily addressed with discrete "crisp" system design inputs. The conceptual approach for integrating resilience in environment design is to understand better how to support mechanisms within the built system that can effectively, efficiently, and reliably adapt and operate under diverse ranges and sources of variation.²⁷

Systems resilience defines the way overlapping elements that comprise social, technical, and structural/mechanical systems react under expected and unexpected events effectively and ideally evolve to an improved state of function.²⁸ Resilience in designed or engineered systems describe the applied use of proactive, adaptive strategies and resources to respond reliably and successfully to anticipated and unanticipated system disturbances.²⁹ Hazards occur within systems due to interactions

among different components that often occur within a system's parameter boundaries or within overlapping control areas that violate system constraints.³⁰ An additional and considerable challenge in designing systems resilience is that the quality of adaptive capacity related to risk response is often evolving and contextually dependent.³¹ For any system to sustain performance resilience, it must manage risk and opportunity preemptively and evolve operational adaptive response.³²

METHODOLOGIES

Human in the Loop (HITL) Artificial Intelligence (AI) leverages both numerical data and the opinions and viewpoints of system Subject Matter Experts (SME) to optimize both design functionality and human experience. The research described in this article used HITL AI comprised of Supervised Machine Learning techniques for analyzing hospital catchment area socioecological risk factors and Fuzzy Inference System Decision Rule Algorithms for determining relative infectivity threat levels to estimate HAI risk potential in environments of care.



Figure 2. HITL AI Socioecological Model Design Programming Cycle

Socioecological Model and prospective Environment of Care (EOC) design intervention data were parsed and labeled through summative content analysis.³³ of themes derived from Literature-Based Discovery (LBD) and SME heuristics. The effort enabled a Principal Component Analysis (PCA) of factors endemic to a health system's catchment area, which had the most notable relationships to community-onset infection or patients at high risk for contracting HAI. An Ordinary Least Squares (OLS) Regression Machine Learning Model was then used to offer increased specificity to different system risk categories and resilience response levels. A decision on environmental performance safety could then be generated as a point within the space of the union of disjoint fuzzy sets of HAI Risk and Environmental Design Resilience where the potential level of environmental performance safety would attain a maximum feasible value. This process revealed how outside design basis risk relates to infectivity potential derived from the context of the healthcare environment.

RESULTS

An examination of the patient catchment data relevant to a Central Florida health system indicated that socioenvironmental demographic independent variables like "People Per Square Mile;" "Housing Cost Burden;" "Housing Transience" and Underlying Conditions like "COPD;" "Diabetes;" and Cancer" are significantly related to the predictive incidence of Clostridioides difficile (C. diff.) infections in healthcare settings in Florida Agency for Healthcare Administration (ACHA) regions

(F(7,59)=149.8, p=<.01 with an R2=.947). Similarly, OLS indicates that regional socioecological variables like "Incidence of Individuals that are Uninsured;" "People per Square Mile;" Incidences of Homelessness;" "Housing Transience" and Underlying Conditions like "COPD;" "Diabetes;" and Cancer" are also significantly related to the predictive incidence of Methicillin-Resistant Staphylococcus Aureus (MRSA) Infections in healthcare settings in Florida ACHA regions (F(8,58)=210.9, p=<.05 with an R2=.967).



Figure 3. PCA Socioecological Model Outcomes

Fuzzy Inference System (FIS) HITL Decision Rule Algorithms were then created for HAI Risk Parameter Assessment Fuzzy Membership Assignment (μ RPA) levels using OLS likelihood outcomes. HAI risk parameter level and LBD and SME informed infection prevention design element efficacy metrics to predict the impact of research-informed environment of care elements on infection control performance safety based on regional infectivity risk event levels established in the precedent step. Design interventions were EOC dependent and included easy to alter building operational components such as environment disinfection methods and biofilm resistant applied contact surfaces. Design strategies also included challenging to implement strategies such as increasing the ratio of private patient rooms in a unit to reduce pathogen propagation. Each of these elements of environment of care design was assigned Resilient Strategy Assessment Fuzzy Membership Assignment (μ RSA) levels based on probabilistic level of bacteria reduction. The intersection of μ RPA and μ RSA were then evaluated to determine a healthcare unit's Performance Safety Assessment (μ PSA) level based on a range of levels of infection risk and design element resilience.



Figure 4. Example of Fuzzy Inference System Decision Rule Consequent Outcome

The purpose of these algorithms is to predict the impact of research-informed environment of care elements on infection control performance safety based on regional infectivity risk event levels. This extension of traditional Risk Analysis using complex computational methods combining Machine Learning and Fuzzy Sets and Inference lays the foundation for in silico infection prevention strategy development and resilience efficacy testing.



Figure 5. FIS Composite 3D-Mesh Model of Trait Association with Performance Safety Outcomes

The utilization of FIS facilitates identifying weights of influence of composite traits of prospective patients on the predictive occurrence of certain types and levels of HAI risk in acute care settings. This step allows for data-informed inferences to be made about the associated environmental strategies that may moderate the spread of pathogens in inpatient treatment settings. The results provide instrumental insight for informing short and long-term design programming related to planning safer care delivery environments that may moderate the spread of AMR pathogens in an EOC.

CONCLUSION

Predictive data analysis frameworks have demonstrated reliability in detecting pathogen colonization rates in specific patient groups and assessing the efficacy of strategies meant to stem microbial transmission within complex healthcare settings.^{34,35} Using HITL AI, Socioecological Modeling for Architectural Programming, and environment of care planning offers a vehicle for forecasting EOC's design and operation ability to meet expected and evolving performance outcomes. Integrating Socioecological models as a framework for environmental scans of patient catchment areas allows for care delivery process stakeholders to consider internal and external variables outside system design parameters. This domain agnostic approach offers insight into what types of purposeful investment in EOC design may moderate complex issues such as community-onset or hospital-acquired infection.

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SPACE-RELATED VULNERABILITY IN THE COVID-19 PANDEMIC: FROM COMMUNITY DWELLING TO THIRD PLACES

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INTRODUCTION

The stay at home measures and lockdowns imposed during the Covid-19 pandemic have shattered the traditional design, perceptions and use of indoor and outdoor spaces, affecting the social representations of the multiple system of urban spaces and how these spaces are experienced. This paper aims to investigate how these changes have affected social health, and personal wellbeing of the most vulnerable segments of society during the Covid-19 pandemic.

A qualitative investigation was developed encompassing narrative interviews on 'space-related vulnerability' with migrants, employing social theory and critical perspective that takes into account the relational and contextualized dimension of vulnerability.

We found that vulnerable subjects suffered more acutely from small and inflexible internal spaces or the lack of usable open spaces. In particular, they were negatively impacted by the virtualization of social and work relationships, and the limitation of socio-recreational activities to the home. The rapid redefinition of the functional use of spaces imposed by the lockdown measures adversely affected their sense of community and social practices with serious consequences for their wellbeing and mental and social health.

This study contributes to the ongoing debate on the rethinking of the design of spaces in the city, encouraging reflection on the "third places" to support the most vulnerable segments of society and promote global health.

TERRITORIAL SPACE

Following Lyman and Scott¹ different kinds of territories exist: *public, home, interactional,* and *bodily* territories. All these territories have been affected by the restrictive measures enforced during the Covid-19 pandemic. *Public territories,* namely urban areas with freedom of access, have been interdicted for the majority of people, with limited access accorded only to specific activities or specific categories of people; *home territories,* that is, public territories that are 'colonized' and regularly used by specific groups, which develop a sense of intimacy and connection - such as sport club or meeting centres for associations and communities - have been reduced to private spaces (households) or massively moved into the cyberspace; *bodily territories,* which refer to the

space immediately surrounding the body, thus defining the bubble of privacy and the vital primary space, have been deeply affected by the prescriptions of interpersonal physical distance.²

During the Covid-19 pandemic health emergency, every form of territorial encroachment was experienced: *invasion*, *violation* and *contamination*.³ Occurrences of people gathering together (or crowding) in public territories have technically constituted an invasion of personal space, with such behaviour being perceived by many citizens as showing a lack of respect for safe interpersonal distances. The unwarranted use of public spaces has constituted a violation, as in the recurrent episodes of people, especially young people, meeting on the streets or in the squares. Finally, *contamination* (or fear of contamination) occurred as a result of the pollution of the space surrounding the bodily territory, pollution that was constantly managed through the rituals of washing hands, sanitizing objects, wearing masks, and keeping a distance. We found confirmation that when some form of territorial encroachment occurs - either violation, invasion, or contamination a set of prototypical responses can be observed, such as defence and insulation. Defence is a violent and aggressive reaction to intruders, which has been invoked as justification for negative attitudes and behaviours towards migrations; insulation is the use of barriers either physical or symbolic employed to protect the territory against possible invaders.⁴

MIGRANTS' VULNERABILITY

As in many other crises, migrants seem to be particularly vulnerable to the direct and indirect impacts of Covid-19. While the lack of properly disaggregated data makes it difficult to quantify the specific impacts they suffer, some evidence of migrants being disproportionately affected by the Covid-19 pandemic has been recorded in certain locations compared to the rest of population.⁵ Their ability to avoid the infection, receive adequate health care and cope with the economic, social and psychological impacts of the pandemic can be affected by a variety of factors, including their living and working conditions, lack of consideration of their cultural and linguistic diversity in service provision, xenophobia, their limited access to social networks offline e online, and the limited level of inclusion in host communities, often related to their migration status.⁶

Our decision to adopt the social model of vulnerability that connect vulnerability to lack of or limited social integration⁷ as well as the assumption of a critical perspective that takes into account the relational and contextualized dimension of vulnerability,⁸ have oriented us to develop a research on migrants' health and urban spaces 'anchored' to the current situation and at the same time 'projected' towards the future of our cities. The results of the survey invited us to indicate a possible way as the development of "third places"⁹ between private space and public space¹⁰ designed in the perspective of sociability.¹¹ This character of third spaces, sociability as the playful form of socialization or pure form of interaction in which no other aims are pursued than that of benefiting from being together, can make cities more ready to host risk societies.¹² Indeed, in order to face the risks, all the new actors coming from civil society must be included. Supporting people in weaving social bonds becomes a preventive measure that tends to make the different frailties that one experiences less suffocating, and becomes an essential ingredient to limit the effects of social vulnerability.

THE SURVEY ON MIGRANTS' PERCEPTION OF SOCIAL SPACES Methodology

This study focuses first of all on the changes brought about by the Covid-19 crisis in the social representations of spaces, both at the cognitive and at the behavioural level among migrants' community members analyzing the effects of these changes on their social health. A qualitative research on the meanings and representations relating to space, health and personal well-being which

includes narrative interviews on the 'space-related vulnerability' of migrants resident in the Marche Region in Central Italy in March-April 2021 has been done.

Telephone interviews were carried out. Specifically, following studies already carried out and present in the literature,¹³ we highlighted the following categories in the interviews: (a) new social practices based on the process of *alienation* in relationships; (b) the new meanings and uses of places that affects the *identity* processes; (c) the differentiation of *open* and *closed* places; and (d) the *novel visibility* of urban spaces and cities.

Recruitment

In order to facilitate a fast and efficient recruitment, in light of the limitations imposed by the pandemic, and to begin data collection quickly, we used a readily available database of migrants from the resident population. We combined convenience and snowball sampling strategies to maximize the variance of our participants' experiences and to rapidly reach a target sample of approximately 90 survey participants. We estimated the target sample size based on prior methodological studies and the adequacy of the data collected.¹⁴

Participants were invited by either e-mail or phone to participate in the study. Information was provided on the study aim and procedures, as well as assurances of anonymity and confidentiality. Participants had to meet the following inclusion criteria to be admitted to the study: be between 25 and 65 aged at the time of the study, be legally resident non-EU citizens, live with a family and be resident in their home in the Marche Region in Central Italy. Once they confirmed their intention to take part in the study, participants were asked to provide a preferred date and time to be contacted, finally they were contacted for the telephone interviews.

Results

The sample comprised 88 migrants. Respondents provided demographic and personal information: age, relationship state, employment status, educational level, residential dwelling. The highest percentage of participants were aged 35/44 (n=38), joined (n=44), unemployed (n=37), and had attended a primary school (n=30). The mean age of the participants was 43 (SD=6.0) in a range of 35-44 years of age.

Alienation perceived in relationships and at work

During the COVID-19 pandemic, the fast redefinition of the functional use of spaces and places imposed by the lockdown measures has generated an impact on common sense and social practices, producing controversial social representations facing the estrangement in the relationship between spatial and emotional closeness through paradoxical semantic antinomies, like "spatial distancing– affective proximity", "close from afar", and "together but divided". Such antinomies are counter-intuitive with respect to the symbolic systems learned in any culture, in which love means general proximity and closeness.

Migrants found it difficult to conceive such paradoxes and endure such antinomies because of their cultural customs and social habits. They reported the perceived risk of coming into contact with the virus and becoming infected, as they don't have always the possibility to comply with hygiene rules in private life and with some difficulties at work. Migrants have perceived the need but hardly adopted the behaviour of keeping distance from their loved ones as a useful act to reduce the risk of contagion, first of all because they lack adequate private spaces and secondly because of the cultural difficulty in conceiving the family and community in terms of separation. They claimed that physical presence was

often required in their simple and humble jobs, thus giving rise to their conviction of being considered as bodies of work sacrificed for the others' benefits.

Deconstruction of subjectivity and the denial of identity

The Covid-19 pandemic, during its different phases, has affected and will affect the social representations of the multiple system of places and their experience (home, urban open places, natural places, socio-recreational places, institutional places, functional places for transport and commerce), and consequently the Self-representation. In this phase of global crisis, much of the subjective spatial experience was subjected to distinct but parallel processes: it was relegated to delimited offline environments where it had to adapt to the necessary restrictions, or it was projected in unanchored worlds, where social relations extend over a very wide spatial scale, making traditional and new media increasingly the vehicles of content and knowledge as basis for the identity.¹⁵

The outcomes of this condition at risk of identity crisis and fragmentation appear more uncertain in the case of vulnerable subjects such as adult foreigners or young migrants who often experience a 'double identity' or 'mixed ethnicity'. During the pandemic, migrants declared that opportunities for encounter, expression and identity re-composition set up in public spaces and intercultural centres disappeared, while confinement in private spaces sharpened the sense of one's diversity and reduces the opportunities for socialization. The final outcome involves the dual possibility of being or trapped in silence or flattened by adaptive styles and behaviours learned from the mass media.

Discomfort felt in private and in public spaces

'Home' has changed during the lockdown from a private family space to a multi-tasking context including a work setting. Indeed, the domestic space becomes the seat of a series of activities that interfere in a succession of often overlapping or sometimes conflicting actions. The transformation of 'home' into a 'plural place' in the time of Coronavirus has involved the privatization of the public sphere and the making public of the private sphere, with audiences entering the intimate space through virtual meetings for school, work, and social activities transferred to the private setting.

In this context, the most disadvantaged social classes have experienced (and suffered) with greater intensity, in recent months, small and inflexible internal spaces or the lack of usable open spaces, as well as inefficient telematic connections or a shortage of computer terminals.¹⁶ The interviewed migrants stated that life in confined private spaces where everyone needs space for their activities is not easy. At the same time, many of them feel the lack of public spaces where they could stay close even without interacting and in any case recognizing each other and affirming mutual presence. Someone lacks the spaces for informal meetings, games, sports and conversation.

Perception of exclusion from public places and discourses

To contain Coronavirus spread, spatial distancing is to be required while promoting social connectedness. Institutions imposing 'social' instead of 'physical' distancing paradoxically have created the conditions for risky behaviours, albeit involuntarily.¹⁷ At the same time, they have generated favourable conditions for practicing social labelling and applying prejudices and stereotypes towards foreigners and migrants¹⁸.

Migrants felt more intense the attitude of detachment with which they were treated by the natives in the places of public health and in the supermarkets, where they went for health services and for the acquisition of basic necessities. Some migrants, denouncing the social prejudices of our culture, have reported the feeling of being excluded from the debate in public space online e offline and to be reduced to a single passive risk category by the authorities, thus favouring their stigmatization and victimization in culture and society. The negative judgment formulated on the use of the city and

urban spaces by natives and authorities is an expression of the feeling of exclusion felt by the fact of perceiving oneself as the recipients of the choices of others, and of being considered work tools that are more exposed to risk and sacrificed, with the consequence of the general belief of being passive victims of events.

In summary, migrants declared they continued to cross and frequent public spaces, transit roads for work reasons, risking more contagion because they were more exposed. For them, public spaces have become places of risk and spatial segregation, ceasing to be an opportunity for social interaction between different races and ethnic groups and for the integration with the local community, thus hindering their capacity to build community and identity. The pandemic changed the relationship between interior and exterior space, relegating migrants with their family into private spaces inadequate to became multifunctional as the physic confinement during the Covid-19 required. In these conditions, they stated that they mainly use mainstream communication technologies and social networks to search for information and for entertainment and social relationships, not for tele-working and for services provided online.

FACING THE FOUR CRITICAL ISSUES

How to address these space-related vulnerabilities and counteract the effects on health and well-being of migrants? In the light of the results of the survey, the proposal may be put forward to introduce practices or exercises of sociability set up in third places, where they would engage in weak forms of communication and a "sociable distancing" for inclusive and participatory sociability. Current conditions can solicit a reflection on third places such as multifunctional spaces, others with respect to the domestic and work spheres, where individuals belonging to different social circles have the opportunity to meet and immerse themselves in interactions, actions and speeches with the most varied purposes.

The 'third' character of certain urban spaces suggests the overcoming of a clear dichotomy between urban places characterized by a good level of quality of life and other contexts where there are no positive standards of well-being, and where a state of discomfort is registered. The third spaces can be characterized by comfort and health as quality spaces: in addition to being identified for their connective and relational function, they can be set up as places for informal learning and various types of health literacy, as civic centres, and as areas for promoting the culture of sport and physical activity. Third spaces - thanks to their playful and informal nature and their attention to contextual factors - should be at the centre of urban space design for the health and well-being of vulnerable people and migrants.

Third spaces can be defined as 'residual' or 'undecided' spaces. The term 'residual' is intended to refer directly to 'what remains' in the fabric of the post-industrial city: spaces of different scales, from abandoned areas to central urban spaces, from the continuous spaces between buildings to paved street areas. Some of these spaces have a distinctly negative connotation: residual spaces are the preferred area where processes of ghettoization and degradation flourish, impacting the weakest social groups. But the 'waiting' or 'suspension' status of some urban environments makes them a potential resources for the community. Indeed, they can effectively meet the need for spaces reserved for fundamental activities in the daily lives of residents, such as study, sport and health, or they can be dedicated to the socio-cultural sphere, representing alternatives to the idea of mere expansion or quantitative urban growth.



Figure 1. Third spaces: Agorá, Individual space, Health space, Exploration space.

CONCLUSION

The need for awareness of the alienation process involved in the new representation of spatial and physical distancing as an act of care towards other group members not as a sign of mistrust, and even towards the vulnerable members belonging to one's own family requires a commitment on a cultural level and from a design point of view, which, on the one side, help to prevent the risk attitude implicit in the safety perception related to the identity belonging to one's own in-group and, on the other side, fight stigma and prejudices associated with the social representation of Covid-19 as the racialized infectious other. Social scientists and psychologists have loudly voiced the well-being argument that it is not only possible but also strongly recommended to maintain social connections even when people are physically distant.¹⁹ If this wasn't the case, a huge public health problem would immediately surface as, especially in times of crisis and emergency, vulnerable people look for support and solace from others: asking them to be deprived of social connections is at odds with their need for socialization and social inclusion, and it has detrimental effects on physical and mental well-being. It is therefore more important than ever to redesign urban spaces of sociability practiced in safety.

In addition, the conversion to smart working of many jobs and activities (shopping online, delivery food...) may have long-term effects on the redefinition of the use of public and private spaces by changing the urban assets and planning and influencing the economy (promoting the digital and green economy) and lifestyles (reducing the need for transportation and travelling and allowing them to earn free time for sport and wellbeing). This could be an opportunity denied to migrants, because of the limited availability of digital tools and acquired digital competencies, and for their employment in simple and humble jobs where a physical presence is often required. Access and management of online and offline spaces becomes crucial for the quality of life and health of the vulnerable citizens.

Third spaces can be an answer. Indeed, they can respond to the migrants' basic needs in the Covid-19 pandemic helping to develop sociability and social inclusion. «Migrants rarely manage to speak in real or media squares, however there is a widespread, weak, fragmented buzz that inhabits third places and can nevertheless be extremely valuable, especially if taken seriously».²⁰ This design of urban

spaces helps citizens to avoid "civic inattention"²¹ and favours social policies in adopting a perspective that is not only compensatory but also promotional and supportive.

NOTES

¹Stanford M. Lyman, Marvin B. Scott, *Territoriality: A Neglected Sociological Dimension*. In: Robert Gutman, ed., *People and Buildings* (New Brunswick and London: Transaction Publisher, 2009): 68-72.

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¹⁰ Valeria Monno & Silvia Serrelli, "Cities and Migration: Generative Urban Policies through Contextual Vulnerability", City, Territory and Architecture, 7(6) (2020), doi: 10.1186/s40410-020-00114-x.

¹¹ George Simmel, Grundfragen der Soziologie. Individuum und Gesellschaft (Berlin: Göschen, 1917).

¹² Ulrich Beck, *Risk Society: Towards a New Modernity* (London: Sage Publications, 1992).

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HOME CARE DESIGN FOR PARKINSON'S DISEASE: APPLYING METHODS FOR HCD TO ANALYSE THE NEEDS OF PEOPLE WITH PARKINSON'S

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INTRODUCTION

Parkinson's Disease is a severe, debilitating neurodegenerative pathology characterized by a progressive and chronic disorder, mainly concerning - although not exclusively - motor symptoms such as bradykinesia, rigidity and tremor. These symptoms cause difficulties in movement and, more generally, in daily life, having a negative impact on People with Parkinson's (PwP) mental health as well as adverse effects on caregivers' quality of life. The prolonged confinement imposed by the Covid-19 pandemic has got worse the difficulties of movement that PwP experience within their homes, highlighting the importance of designing domestic spaces suited to their needs to reduce the burden of their suffering and improve their quality of life.

The aim of the research program Home Care Design for Parkinson's Disease is the definition of guidelines for the design and implementation of an inclusive and accessible home environment for PwP.

25 PwP (of various gender, age and levels of symptomatology) and 16 informal and formal caregivers (of various gender, age and experience) from the Tuscany region, were involved in this study. Due to Covid-19 pandemic restrictions, the research methodology was modified. To receive qualitative data, 2 methods of the Human-Centred Design (HCD) approach were used. Specifically, exploratory semi-structured interview (phase 1) and specific structured interview together with the home virtual observation via video call (Skype and Zoom platform) (phase 2).

The results of the evaluation phase were useful for the definition of common intervention areas. Overall, the major resulting problems are related to the following aspects: (i) vertical and horizontal paths, (ii) rooms dimensions and (iii) assistive devices.

The contribution of this article is to describe the application of methods of the HCD approach, in assessing the needs and defining the technical and technological requirements for the home environment to be more inclusive and less invasive for PwP and their caregivers.

PARKINSON'S DISEASE

Parkinson's disease (PD) is a severe, disabling neurodegenerative disease, characterized by a progressive and chronic disorder, associated with motor symptoms (e.g. tremor, rigidity, postural instability, bradykinesia, gait disturbances, freezing, falls and dizziness, altered blinking and eye movements) and non-motor symptoms (constipation, swallowing problems, hyposmia, urinary problems, hallucinations)^{1 2}. In addition to the problems strictly related to physical symptoms, Parkinson's people (PwP) are more frequently exposed than the general population to the risk of emotional and behavioural disorders, mood disorders, apathy, alexithymia, and anxiety and depression ¹³. Several studies highlight how PwPs frequently experience embarrassing situations, linked to motor difficulties, tremors and falls, with consequent withdrawal and social isolation ⁴. Furthermore, stigma often affects their everyday life with a negative impact on their quality of life ⁵⁶⁷.

In industrialized countries, the estimated prevalence of PD is 0.3% of the general population, but it reaches 1.0% when considering people over the age of 60 and 3.0% of the population older than 60-80 years. PD incidence rates are estimated between 8 and 18 per 100,000 people per year ⁸. This number is set to grow enormously over the next few years. Parkinson's is the fastest growing neurological disease, now higher than Alzheimer's. The number of patients doubled between 1990 and 2015 and some forecasts foresee a further doubling by 2040, suggesting what some scholars have defined as "the Parkinson's pandemic" ^{9 10}.

RELATIONSHIP BETWEEN THE BUILT ENVIRONMENT AND PD

The built environment is the structure made by humans to live in and work in. As stated by WHO, many people suffer from an impairment or condition that in a specific environment becomes a disability¹¹.

A normal person spends about 8-14 hours a day into you're his/her home, while a person with severe PD can spend up to 24 hours a day at home. Disability is part of the human condition¹¹, temporary or permanent, which can be experienced at any time of life. The quality of life is very often related to the quality of living spaces and daily use of objects. For example, a room that is too small or kitchen cupboards that are too high create barriers to carrying out common daily activities.

When health declines, environmental limitations often do not match individual capabilities, causing problems with several person-environmental fit (P-E Fit) with negative health outcomes. P P-E Fit reflects the relationship between the environment and the individual^{12 13}, as the correspondence or congruence between individuals and their environments, namely a key determinant of a person's well-being and efficacy ¹⁴.

In Italy, the accessibility of building for civil habitation is guaranteed by two main laws: Legge 13/1989¹⁵ and Decreto Ministeriale 236/1989¹⁶. These laws consider the disability in its broadest meaning, so the indications contained therein may not meet the needs of PwP and caregivers. The current state highlights how much private housing represents yet another hostile example for the elderly, the injured and the disabled.



Figure 1. Photos of the spaces in the homes of the sample involved in the research program by the Laboratory of Ergonomics and Design.

METHODOLOGY

Design for and with People: Human-Centred Design approach and Inclusive Design approach

The starting point for designing accessible home environments is an attitude toward design that begins with the ability to pay attention to the context in which one is called upon to design. The context is defined by users, activities, equipment, and physical and social environments in which a product is used¹⁷, namely the complex and changing set of all the elements that define the relationship between people and their living environment.

The ISO 9241-210:2010 defined Human-Centred Design (HCD) as an "approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques".

The investigation methods of the HCD approach can be divided into methods involving direct or expert evaluation by researchers (expert evaluations), and methods that call for direct user involvement (empirical evaluations).

The focus on the people and the aim of addressing their specific needs and expectations, underline the close relationship between the HCD approach and Inclusive Design (ID), which is considered an integral part of the HCD approach¹⁸.

The BS 7000-6:2005¹⁹ defined ID as an approach that "aims to deliver 'mainstream products and/or services that are accessible to, and usable by, people with the widest range of abilities within the widest range of situations without the need for special adaptation or design".

The ID emphasizes the diversity of the person, HCD highlights its scientific and methodological characteristics, through methods to support ID. Accessibility and usability are the key points of these two approaches.

Home Care Design for Parkinson's Disease: research project

The aim of the research program Home Care Design for Parkinson's Disease is the definition of guidelines for the design and implementation of an inclusive and accessible home environment for PwP.

The guidelines aim to define the most suitable design solutions to ensure maximum usability, safety and pleasantness of use of the home, its furniture and equipment.

The research program, carried out in the period 2020-2021, involved different research groups belonging to university departments of the University of Florence and Universidade Federal de Minas Gerais (Brazil) (Design area), University of Turin (Medical area) and University of Catholic of Sacred Heart (Milan) (Sociology area). Finally, an important contribution was provided by the two Italian sector associations on Parkinson's, such as: Confederazione Parkinson Italia and Accademia Limpe-Dismov.

The study involved the participation of 25 PwP (of various gender, age and levels of symptomatology) and 16 informal and formal caregivers (of various gender, age and experience) from the Tuscany region, and more specifically residing in the provinces of Florence, Prato, Pisa, Livorno and Grosseto.

Due to the spread of the Covid-19 virus, and considering the limitations imposed by the virus, the methodological approach, previously defined, changed, both from the organizational point of view and from the time point of view.

To receive qualitative data, 2 methods of Human-Centred Design (HCD) approach²⁰ were used. Specifically, exploratory semi-structured interview (phase 1) and specific structured interview together with the home virtual observation via video call (Skype and Zoom platform) (phase 2).

Exploratory semi-structured interview

Phase 1 concerned the exploratory semi-structured interview. It was conducted by telephone and aimed to investigate some aspects of the PwP and eventually of a caregiver (formal and informal).

The interview covered areas of inquiry were the following: Parkinson's disease, home, aids and assistive technology, job and public services.

More specifically, concerning PD, the PwP, and then the caregiver (if any), were asked to describe their typical day, explaining which activities require assistance, which ones are carried out with ease which ones with difficulty and investigating the respective difficulty level.

Concerning the home, they were asked to give an overall assessment of their home, indicating which spaces create discomfort and which ones create comfort.

From the point of view of aids and assistive technologies, PwP were asked if they use any of them, what is their opinion about them, who has recommended them and which ones are the best.

On the other hand, concerning the public services near home, they were asked what services are available, how far away they are, how they are reached and whether they have experienced any difficulties in accessing them. Finally, the last area of inquiry concerned job. Participants were asked about the type of work they do and how Parkinson's is affecting their work.

Specific structured interview and virtual observation

Phase 2 concerned the specific structured interview. This second interview was conducted with a selected group of users (n=18), previously involved during the semi-structured interview. The motivation of this selection was dictated by the level of PwP symptomatology. To receive more interesting data, the researchers decided to interview PwP with a medium / severe level of symptomatology (level from 2.5 to 5 according to the Hoehn and Yahr scale) $^{21 22}$. More specifically, the following 6 questions were asked: (i) How many rooms are there in your house? (ii) Given Parkinson's disease, what features should have your ideal home? (iii) On a scale of 1-5, with 1 being the lowest and 5 being the highest, how satisfied are you with your home? (iv) In your opinion, how can be improved in your home? (v) Does technology improve your life in your opinion? If so, what kind of technology do you refer to? (vi) How do you feel about a home able to change its own space according to a specific need? Do you think a flexible/changeable home would work for you?

Once the interview was completed, the participants were asked to document through a video call (Skype and Zoom platform) the environments that set up their homes and the objects that are ordinarily used by them.

RESULTS

Regarding phase 1, most of the subjects who took part in the study live in the city (n=11) and the suburbs (n=9), while a small portion of the recruited sample lives in the countryside (n=5) (see Figure 2).

Those who live in the city can enjoy the services and conveniences "at their fingertips", while they may have limitations from the point of view of the size of the rooms and the presence of outdoor space (garden, exclusive terrace), unlike those who live in the suburbs or the countryside, who can generally benefit from the proximity of accessory services to the house.

In terms of the living plan, most of the subjects' homes are developed on a single floor (n=20). Only 3 out of 25 subjects stated that they live in a home that is developed on multiple floors (see Figure 2).

The interview revelated that 16 out of 25 users are satisfied with the house they live in, as they have sufficiently large square footage. While the remaining portion (n=9) attributes a negative value to the house where they live. The most of discomfort/problems are related to the size of the bathroom, the presence and size of the stairs, and finally the presence of small spaces such as the closet (see Figure 2).



Figure 2. Location of dwelling (top left), the composition of dwelling (top right) and judgment of dwelling (bottom).

As for phase 2, data show that 13 out of 18 subjects want housing solutions with bathrooms of adequate size to ensure access and rotation of wheelchairs in addition to the space needed to install grab bars and a shower seat. Afterwards, some participants(n=10)-give great importance to the stairs. Although they know that stairs, depending on the level of PD symptomatology can be an incentive to reduce freezing, they prefer single-storey housing solutions. In addition, 7 out of 18 subjects stated that they need greater accessibility within the kitchen environment, even those forced to sit in a wheelchair or use a walker.

The greatest problems concern the use of walls and base units in the kitchen as well as the appliances provided. 5 out of 18 subjects give great importance to adequate space for the rooms that set up the home, and finally, to the usability/accessibility in their home of walkers and wheelchairs. At last, 4 subjects out of 18 claim the need rooms of suitable size for wheelchair access, open space solution (at least between the kitchen and living room) and indoor spaces where it is possible to exercise (see Figure 3).

In the end, 16 users out of 18 stated that flexibility and versatility can be a valid alternative to static walls, trusting that a changing space according to PwP and caregivers' needs is a valid idea (see Figure 3).



Figure 3. Preferences expressed in the question "Given Parkinson's disease, what features should your ideal home have?" (left) and opinion towards home flexibility (right).

Home environment	Description of problems and areas of intervention
Vertical paths	- some users complain about the presence of steps or staircase;
Horizontal paths	- lack of large spaces to ensure the passage and rotation of the walker or
	wheelchair to ensure home accessibility and to limit freezing;
	- lack of space or unsuitable spaces between the objects of use in the
	house, such as table-chair, chair-sofa, table-kitchen, etc.;
	- lack of space to allow wheelchair rotation in some rooms of the house;
	- difficulty in passing through narrow doorways or tight spaces (e.g.,
	corridors);
	- difficulty in walking due to the presence of obstacles in horizontal
	pathways (sofa, chair, bed, furniture, etc.);
	- the presence of height differences in outdoor space (terrace, garden,
	etc.);
Room dimensions	- useful space in the bathroom to allow access to the caregiver during
	PwP hygiene and cleaning;
	- lack of sufficient space for physical activity, physical therapy and/or
	recreation activities;
Accesses	- difficulty in opening and closing doors and windows;
Furniture, aids and assistive	- lack of grab bars and/or support elements in the most critical points of
technology	the house (corner where changing gears are expected) for fall prevention;
	- lack of space to install grab bars in the bathroom;
	- difficulty in reaching low furniture. Some users complain of difficulty
	in bending over to equip themselves with objects placed in the kitchen
	base units or in the lower cabinets;
	- difficulty in getting out of bed or armchair (beds, armchairs and static
	sofas). Many PwPs support motorized beds, chairs and sofas;
	- little knowledge of aids or assistive technology for Parkinson's or other
	motor impairments.

Overall mapping of the issues and needs that emerged is provided below.

Table 1. Global mapping of problems and needs.

DISCUSSION

The results show that the approaches used are valid in identifying the everyday difficulties experienced by PwP and the unspoken needs of people who share the same home environment.

Although the restrictions imposed by Covid-19 made it necessary a review of the research design, both the exploratory semi-structured interview and the specific structured interview and observation of the context allowed to identify a clear and precise global mapping of problems and needs.

Furthermore, the results indicate that most of the houses understudy, or portions of them, are not suitable, or may not be suitable in the future, to accommodate a PwP and his/her caregiver. The problems related to the small size of some of the rooms, such as bathrooms and bedrooms, together with the static nature of the walls and vertical differences in height, raise challenges that require action from different viewpoints, such as cultural, social, political and design aspects.

Lastly, since this research project is halfway between interior design and product design, and specifically addresses to the field of health and care, some topics were deliberately not investigated, such as systems, lighting and display as well as the bureaucratic aspects, to focus on the quality of the basic spaces of the PwP and caregivers' home.

CONCLUSION

The home Care Design for Parkinson's Disease research project, whose objective was to assess the needs of PwP and their caregivers and then draft guidelines for creating a fully usable home environment, has revealed several positive and negative aspects. On the one hand, the sample under study showed a lot of enthusiasm, interest and participation in the objectives of the research. This aspect is particularly significant in terms of knowledge of needs and satisfaction of needs, helping the team in the phase of the production of the guidelines. On the other hand, the study involved subjects from Tuscany only. Therefore, it is not nationally representative, as every region in Italy has its architectural characteristics in terms of conformation, size and height of interior spaces. For this reason, to have a complete overview, further studies at a national level would be necessary.

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EMPLACING WESTERN HEALTH IN INDIGENOUS SPACE

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INTRODUCTION

This paper argues that place – or more specifically, *dis*-place-ment is an under recognised factor in ill health for First nations communities. It presents the method for a creative, cultural, place-based clinical research intervention that is underway. The model has been developed as an inversion of Indigenous culture as a supplement to Western bio-psycho-social treatment practices, by *emplacing* Western clinical care in an Indigenous space. Moreover, the model enunciates a qualitative adaptation of 'grounded theory' that includes researchers and practitioners from different disciplinary and Indigenous and non-Indigenous cultural perspectives interpreting pre- and post- treatment interviews.

Australia has been particularly poor at reckoning with its history. Claimed for the British Crown in 1788 under the spurious Doctrine of Discovery and declaration that it was a Terra Nullius – an empty land – settler-colonization unfolded in the absence of a Treaty with First Nations peoples. Cycles of displacement, imposition and denial continue to this day. As Patrick Wolfe has argued, settlercolonialism is an ongoing structure bent on 'elimination of the native' that reinvents itself each generation.¹ In health this is evident in the imposition of a Western health care model on First Nations peoples, without sufficient regard to cultural differences. Western health has assumed that hospitals are healing places, but for many Aboriginal people hospitals are alienating – physically, socially and culturally. Consequently, Indigenous Australians suffer from a range of disparities in health metrics: higher infant mortality, lower life expectancy, higher levels of mental health disorders and self-harm, and suicidal ideation. Research has shown that First Nations people are twice as likely to need hospitalization than non-Indigenous Australians, but more likely to avoid going until there is no other option.² When it comes to mental health stress, mental disorder and self-harm are much higher than for non-Indigenous Australians, but hospital presentations are much the same. (First Nations 20%non- First Nations 18%).³ And for depression specifically, First Nations young people report higher levels of depression but have lower rates of admission for comparable levels of depression than their non-First Nations peers. These comparisons are consistent across a variety of national and international databases.⁴

There have been two health care approaches up until now to meet the needs of First Nations people. One has been to develop a parallel community-based network of Aboriginal health services. The other has been to develop Aboriginal Health Liaison Units within hospitals focused on supporting First Nations people to navigate a Western health setting and comply with treatment plans proffered. Aboriginal controlled health services were set up in the 1970s, the first in Redfern, Sydney in 1971.⁵ While these are community controlled, culturally safe places for Aboriginal people, they are few and far between and are unable to deliver tertiary or quaternary emergency, acute and ongoing care. Aboriginal Health Liaison Units, on the other hand, provide a culturally safe space within tertiary hospitals, but they are more often than not small and under-resourced. They are also marginalised within the hierarchy of power relations based on Western medical specialization. Although there is no doubt both of these services have been enormously important for First Nations people, they are clearly not sufficient to address the yawning gaps in health.

In recognition of these problems, a politically bipartisan, national, and state government strategy, "Closing the Gap", was established in 2008, setting ambitious targets to reverse First Nations disadvantage.⁶ While there have been some successes, a ten-year review completed in 2018 was excoriating. It found that mortality and life expectancy gaps had actually widened rather than closed.⁷ Meanwhile, a narrative literature review revealed that there is a dearth of research that has actually studied how people access mental health care.⁸ The Review asserted that a key reason has been that despite the initial promise of a partnership when the "Closing the Gap Statement of Intent" was first co-signed by Aboriginal and Torres Strait Islander peak organizations, the "Closing the Gap Strategy" was devised wholly without the input of Indigenous people. The review recommended the Strategy be refreshed and this time, co-developed with Aboriginal and Torres Strait Islander peak bodies.

A new National Agreement to share decision making on how to close health gaps and inequities was signed by Federal, State and Local governments and Aboriginal and Torres Strait Islander peak organizations in 2019.⁹ Whether this new approach is successful remains to be seen, but early signs are promising. In the past two years, three major Medical Research Futures Fund grants worth around \$13m collectively have been given to First Nations clinical researchers: Sandra Eades, Pat Dudgeon and Michael Wright. A further Australia Research Council grant has been awarded to a team led by architectural anthropologist, Paul Memmot.¹⁰ The authors of this paper lead one of the research projects in Eades Program Grant.¹¹

DISPLACEMENT: UNDER-RECOGNISED FACTOR IN MENTAL HEALTH & WELLBEING

Cultural geographer, Sarah de Leeuw, has argued that the determinants of health for Indigenous peoples need to be expanded beyond the human to include a relational understanding of the spatial, locational and material contexts within which people live. In traditional Indigenous knowledges around the globe, place is not subordinated to human social systems.¹² Rather place – or *Country* as it is called in Australia – is believed to be animate. Elements that are defined as inert or non-sentient in Western epistemologies are regarded in Indigenous epistemologies as living, powerful forces that shape human existence. Displacement from such a life force has significant impacts on mental health and wellbeing. Relationships are torn asunder and health, in turn, suffers.

First Nations people have been cyclically displaced, both individually and collectively, from sustaining environments, with varying scales and degrees of intimacy, since settler-colonization. At the risk of rendering a complex, situation simple and depicting what are new hybrid realities for First Nations people, as a binary condition, the diagram in Figure 1 attempts to explain the process of displacement for those unfamiliar with Australia's history of colonisation. Mass relocation of people from their tribal lands – *Country* - to missions and reserves unfolded between the 1820s and the 1920s.¹³ No state was unaffected, but smaller state with higher populations were more complete in their dislocation of people from their lands. This process enacted a dislocation on another scale: families from their clans, taking culture and language in the process. Different clan groups, with different languages were co-located on other tribal groups' *Countries*. A further series of Acts

beginning in 1849 gave governments the right to remove First Nations children from their families for adoption or servitude by settler-colonizers.¹⁴ This has led to what has become known as the "Stolen Generation."¹⁵



Figure 1. Layers of displacement.

While these acts were repealed everywhere by the 1970s, new practices have emerged that continue dislocation. Out-of-home care numbers, where children have been removed by the social welfare system, are at historically high levels – 11 times the rate for non-Indigenous children; and although Aboriginal and Torres Strait Islander people make up only 2% of the population, they make up 27% of the prison population. These enduring processes have had a profound effect on mental health and wellbeing amongst First Nations communities. First Nations people have very high rates of intergenerational trauma and together these factors provide some insight into why most Western institutions are regarded with suspicion, by First Nations people – not just carceral institutions like courthouses and prisons, but schools and hospitals as well. They are arguably a key reason why First Nations people avoid going until to hospital if they can help it.

EXPLORING THE EFFECTS OF EMPLACEMENT IN CIRCLES OF CARE

Ironically the very practices of displacement that have been instrumental in creating trauma are now the practices that Western health care uses to intervene in offering care. Seeking help from a healthcare professional usually requires going indoors into hermetically sealed, sterile environments, often in busy cities with expensive parking and limited accommodation options. Treatment regimens may be bio-psycho-social, at best, but are rarely cultural too. Dislocations from *Country*, community and family are a part of everyday health and welfare care in urban Australia.

Clinical intervention

Our research project, mirrors in reverse, these displacements. It is a process that instead wraps young people up again in layers of supportive relationships – with *Country* and Elders, creative practitioners, and health care professionals who have Indigenous heritage. It begins with the premise that all land in Australia is unceded Aboriginal land. Furthermore, Aboriginal cultures, included practices that supported health and wellbeing, developed in deep interconnection with this continent for approximately 60,000 years. Western health is a recent interloper. Our project asks, could Western healthcare practices, instead, be re-positioned to reflect this fact? Could Western health be reimagined emplaced within Indigenous cultural practices instead? We are exploring whether an immersive

cultural experience in country, nested within layers of care by an Indigenous health care team, will have a positive impact on a young person's journey to better mental health.

There are a few culturally specific mental healthcare models that are developing concurrently.¹⁶ Wright, Dudgeon and colleagues are evolving a co-design model at multiple levels of mental health service organisations in metropolitan and regional settings in Western Australia. Mental health staff are joined by Aboriginal Elders and Aboriginal young people at the heart of the co-design nexus. In our research project, the engagement, assessment, formulation, treatment planning and implementation steps all occur nested within Indigenous place and culture, governed, supervised and nurtured by First Nations Elders. Mi'kmaw Elder Albert Marshall's model of two-eyed seeing has been influential. In this approach the best of health care practices from both Western and First Nations come together as valued equals.¹⁷ Of course, the challenge with such an approach is finding an equilibrium or balance point that does not tip in favour of one at the expense of the other. In our research project, we are considering how to bring excellence from both cultural traditions together in a new power relationship embedded in spatial, programmatic, and clinical change.



Figure 2. everything sits on unceded Aboriginal land.

Indigenous Australian culture is diverse, so developing an approach that is broadly applicable to Aboriginal and Torres Strait Islanders is challenging. Prior to colonisation there were over 250 Aboriginal and Torres Strait Islander language groups, and over 750 dialects. Customs and cultural health practices were equally varied. In the three centuries following colonisation, Indigenous cultures became more complex still through the intermingling of cultural groups in the missions and reserves and the impact of various waves of settler cultures. Few people live on their own Country; many do not know their Country: and many of the young people who present with severe mental illness are disconnected from their communities and biological family. One third of all Indigenous Australians now live in capital cities and therefore urban health facilities need to be a key focus for Indigenous health care into the future. Contemporary Indigenous social and cultural identity, therefore, is a complex assemblage formed from both the interiorities of Indigenous cultural histories and the exteriorities of settler cultures, varying from individual to individual. Nevertheless, Zubrick et. al. identifies that connection to culture has a positive effect on health and resilience.¹⁸ A similar finding was reported on national consultations by the Australian Department of Health with 600 Aboriginal and Torres Strait Islander people in 2017, which affirmed the importance of practising Culture for Indigenous social, emotional and spiritual health and wellbeing.¹⁹ Although focused on social and cultural determinants of health, the report states that this can involve 'a living relationship with Ancestors, the Spiritual dimension of existence, and connection to country' amongst other things. In light of this we consider that relationship with any country might be beneficial, even if it is not one's own *Country*.²⁰

The study trials an alternative model of care for Indigenous young people that incorporates guided Indigenous cultural practices led by Elders and Indigenous creative practitioners to facilitate an embodied and creative expression of culture by the young person, alongside their standard Western biopsychosocial clinical treatment. Participants are young people aged 10-18 with a mental illness who identify as Indigenous and present to the Wadja Aboriginal Family Place Clinics at the Royal Children's Hospital (RCH). The inner ring of care is provided by an Aboriginal project coordinator who attends all sessions with the participant and conducts the pre- and post- interviews. The next circle is their care team that includes a Western trained psychiatrist or psychologist with First Nations heritage and an Elder who can guide them on a cultural journey to discover their family connections, Stories,²¹ and teach them cultural healing practices such as *Dadirri* meditation.²² The Elder may also appoint a creative arts practitioner - visual artist, dancer, musician or storyteller - to join their healing team to facilitate a creative expression of the young person's emergent cultural connections. These Indigenous Cultural Practices are core cultural activities common to Victorian clans and language groups and have been used to facilitate and maintain the health and well-being of Aboriginal people for thousands of years.²³ The specifics of the interventions will vary and are not pre-determined by the research team as the spiritual-physical context is unique for each Indigenous young person and their family or carer given the variety of expressions of Indigenous cultural identity.²⁴ Men's and women's business protocols are observed. The next circle of support and cultural supervision is provided by a governing Board of Elders which meets quarterly.



Figure 3. emplacing Western health care within Indigenous space.

Enveloping these human relationships are the relationship the young person is encouraged to develop with *Country*. A number of different places have been identified adjacent to the main campus of the hospital and nearby outpatient clinics, which allow the participants to escape the confines of the hospital building and enter into a dynamic experience of sacred and living environments in which creative works can be explored and produced. These include the parklands surrounding the RCH main campus which happens to be a pre-colonial Kulin Nations gathering place for culture and business and a place many Aboriginal staff find sustenance.²⁵ It continues to be a rare place in inner Melbourne where endemic grasslands and ancient eucalypts persist. A new Nature Play children's garden and playground immediately to the south of the hospital incorporates endemic species of trees, grasses and shrubs to reveal the seven seasons of the Wurundjeri calendar. It also has areas for water play. While this is not a private area, it has been successfully used in culturally engaged care. Another site is the

RCH Mental Health service outpatient clinic at Travancore 2km from the hospital on a hill above a bend in the Moonee Ponds Creek. It is a former school built in the 1970s and surrounded with a mature native garden and open space. A final site available to the team is an animal assisted therapy clinic 35km north-west of Melbourne on a small acreage. The new model of clinical care, will continue to include a Western bio-psycho-social treatment plan that may include medication and cognitive behavioural therapies, but importantly it also offers the young person a new set of relationships – with people and with more-than-human entities emplaced within a carefully selected environment.

Method of Analysis: Resisting Cultural Bias

We have combined two methodologies to develop a rigorous approach to exploring the results. The overarching methodological approach is 'grounded theory', which begins with open ended questions posed to participants before and after their cultural encounters, drawing inferences 'grounded' in situations and experiences.²⁶ Because grounded theory typically focuses on expression through verbal language, and some of the participants may struggle to express themselves verbally due to their youth and mental illness, we are also using 'reflexive creative research'. Reflexive creative research is an emergent methodology much like grounded theory that uses creative expressions rather than textual/verbal language as the primary data. Both are constructivist/interpretivist theoretical approaches focusing on meaning and interpretation - that is drawing on both participants, clinicians and researchers' understanding and construction of their perceptions.²⁷ Informed by the Pragmatist tradition of Dewey and Mead, these approaches emphasize that knowledge arises through the acting and interacting of self-reflective beings. It also presumes that humans change the world around them continually through actions and interactions as they make sense of their experiences.²⁸ Both approaches are also inductive, with theory arising from the interpretation and analysis of the data itself and is particularly useful for developing new theoretical perspectives.²⁹ Any theory of how (and whether) Indigenous cultural practices aid health and wellbeing will be formed by developing a 'plausible' relationship around the themes that emerge from the details of the conversations and creative responses that are repeated by many participants.

A limitation of both approaches is a researcher's implicit bias. If assistive software is used to filter conversation, results can also be skewed by cultural or social factors such as choice of vocabulary or use of particular idioms. Visual languages are equally open to varied interpretations. Self-reflexivity that is, each of the interpreters carefully reflecting on their own bias – and theoretical agnosticism are integral for grounded theory methodology to be robust. To that end we are multiplying the perspectives we draw on through interviews with up to five participants: the young person, their family/care giver, Elder, artist/traditional healer, and therapist. Further, our research team reviewing the transcripts and visual material will include both authors - one a child psychiatrist with Northern Wathaurung heritage; the other a non-Indigenous architect and creative researcher, who has researched Indigenous placemaking practices with Victorian communities for over a decade – and the project coordinator, a young woman with Iman Gangulu and Wiradjuri heritage. This is a refinement of the traditional grounded theory approach in recognition of the wide variation in Indigenous cultures across Australia and the importance of non-verbal, creative forms of expression inherent in the proposed intervention. Each has their own social and educational background that shapes the way material will be interpreted. Grounded theory outcomes are strongest when multiple perspectives are considered in an open, dialogic and reciprocal relationship.

A further body of theory that is influencing our approach is a creative research method outlined by Laura Brearley and Treahna Hamm.³⁰ Their model describes a way of learning, working and being

together. It is informed by the concepts of community and reciprocity and uses 'deep listening' – a way of listening respectfully to build community. As Treahna describes it: "Aboriginal people don't give information easily. You have to really listen. Not only listen with your ears but with your heart. Deep Listening is about listening with your heart." This informs the way we work together as a bigger team, but also value we place on the reflections the Elders/Senior People and Advisory Group members bring to the project.

CONCLUSION

This project joins other projects led by First Nations health researchers that are addressing the failures of Western mental health care for Indigenous peoples through incorporating culturally specific practices to support better health and wellbeing. The challenge with each is keeping the best elements of Western medicine without relegating culture to the background. Western hospitals are increasingly considering 'cultural safety' for First Nations patients, in order to render them more compliant with Western treatment plans. This project reverses the approach. By emplacing Western clinical care in Indigenous space - a multilayered Indigenous context that includes *Country* and Elders, creative practitioners, and health care professionals who have Indigenous heritage - our project acknowledges that settler cultures in Australia float on the surface of the longest continuing human culture on the planet.

NOTES

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² Australian Institute of Health & Welfare. *Australia's Health 2018*. Australia's health series no. 16. AUS 221. (Canberra: AIHW, 2018), accessed January 28, 2022, https://www.aihw.gov.au/getmedia/7c42913d-295f-4bc9-9c24-4e44eff4a04a/aihw-aus-221.pdf.aspx?inline=true

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⁷ Chris Holland, *Close the Gaps - 10 year Review* (Canberra: Close the Gap Campaign Steering Committee for Indigenous Health Equality, 2018), accessed 1 December, 2021, https://humanrights.gov.au/our-work/aboriginal-and-torres-strait-islander-social-justice/publications/close-gap-10-year-review.

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⁹ Closing the Gap in Partnership, accessed 1 December, 2021, https://www.closingthegap.gov.au/partnership
¹⁰ Sandra Eades et al. "Bringing family, community, culture and country to the centre of health care: culturally appropriate models for improving mental health and wellbeing in Aboriginal and Torres Strait Islander young people", MRFF ID 1179461; Pat Dudgeon et al., "Generating Indigenous patient-centred, clinically and culturally capable models of mental health care", MRFF ID 1178803; Michael Wright, et al., "Our Journey, Our Story: Building bridges to improve Aboriginal youth mental health and wellbeing", MRFF ID 1178972. Accessed 1 December, 2021, https://www.health.gov.au/sites/default/files/documents/2021/07/foi-request-2464-ministerial-submission--million-minds-mission-grant-funding-approval-ministerial-submission-ms19-000727-million-minds-mission-grant-funding-approval-ministerial-submission to improve Indigenous health outcomes", ARC ID: DP160100494, Accessed 1 December, 2021

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¹² Sarah Leeuw, "Activating place: geography as a determinant of Indigenous peoples' health and well-being". *Determinants of Indigenous Peoples' Health in Canada: Beyond the Social.* Toronto: Canadian Scholars' Press, 2015, 95.

¹³ AIATSIS, "Missions and reserves records" https://aiatsis.gov.au/family-history/family-history-sources/official-records/mission-and-reserve-records

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¹⁷ Andrea McKivett, et al. "Two-eyed seeing: A useful gaze in Indigenous medical education research." Medical education (2020) 54:3, 217

¹⁸ Stephen Zubrick, et al. "Social determinants of Aboriginal and Torres Strait Islander social and emotional wellbeing", in Dudgeon, P., Milroy, H. and Walker, R. (eds), *Working Together: Aboriginal and Torres Strait Islander Mental Health and Wellbeing Principles and Practice*, (Canberra: Commonwealth of Australia, 2014).

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 20 This may seem a subtle argument, but the difference between one's rights to, responsibilities for and relationship with tribal lands – *Country* – is profoundly different from the relationship one has to other environments – which we call country as a way of differentiating the two.

²¹ Marcia Langton. 'The edge of the sacred, the edge of death: sensual inscriptions', in B. David and M. Wilson (eds), *Inscribed landscapes: marking and making place*, (University of Hawai'i Press: 2002), 254.

²² Miriam Rose Ungunmerr, "Dadirri: Inner Deep Listening and Quiet Still" Miriam Rose Foundation, accessed January 28, 2022, https://www.miriamrosefoundation.org.au/dadirri/

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ADVANCING HEALTH EQUITY THROUGH INCLUSIVE DESIGN

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INTRODUCTION

Health equity is a burgeoning area of interest in the discipline of architecture, as is evident by the recent launch of the WELL Health Equity Committee, a global initiative aimed at bringing an equity lens to healthy buildings.¹ Inclusive Design, an approach for creating safe, equitable, and accommodating environments for a diversity of building users, is primed for informing future health equity strategies – both within the context of the built environment and beyond to include systems, policies, and programming. This investigative paper synthesizes literature to understand better how Inclusive Design informs health equity using the five Social Determinants of Health (SDOH) as a guiding framework: *Economic Stability, Education Access and Quality, Health Care Access and Quality, Social and Community Context*, and *Neighborhood and Built Environment*. Gaps in literature will be addressed with proposed opportunities for advancing health equity through Inclusive Design of the built environment. Audiences for these findings include practitioners, architectural researchers, public health experts, policymakers, and other building professionals interested in strengthening health equity initiatives through design.

While health equity is a broad and complex topic, it can be defined simply as having a "fair and just opportunity to be as healthy as possible."² Health equity initiatives are surging globally, particularly as the COVID-19 pandemic continues to ravage the world's most vulnerable populations.³ Key public health experts have surmised that providing opportunities to health is not enough to address systemic health inequities. Rather, "health equity entails focused societal efforts to address avoidable inequalities by equalizing the conditions for health for all groups, especially for those who have experienced socioeconomic disadvantage or historical injustices."⁴ Put differently, to truly address health equity it is necessary to recognize that people start from different vantage points when it comes to achieving health.⁵ Inclusive Design, an interdisciplinary approach used widely across the fields of architecture, industrial engineering, technology, healthcare, and others, similarly espouses the value of applying an equity lens to arrive at crosscutting solutions that work for people of varying abilities, backgrounds, and personal identities.⁶ Despite the pressing need to advance health equity, scholarship that explores the relationship between the design of the built environment and health equity is just emerging. Inclusive Design is one approach of many that can serve to bolster health equity initiatives. There is ample debate over the nuances between Inclusive Design and similar approaches such as Universal Design, Human Centered Design, and Barrier Free Design, among others. This paper adopts the well-established strategy of using an umbrella term to facilitate a discussion across likeminded efforts.⁷ *Inclusive Design* is used here as key terminology, however literature focused on Universal Design and Human Centered Design will also be referenced and noted accordingly. While originally intended to benefit people with disabilities, today Inclusive Design has expanded to address issues of social justice, equity, and broader inclusion across diverse populations.⁸ Furthermore, Inclusive Design principles are used to inform systems, programs, policies, processes, and design of products and built environments, and other applications.⁹ This paper seeks to further inform the ongoing evolution of Inclusive Design by exploring how the approach may be applied to advance health equity.

METHODOLOGY

Efforts to weave together vast amounts of literature on the linkages between Inclusive Design and health equity have not been previously undertaken. A literature review was conducted to identify relevant sources for review by a variety of methods: Avery was used as the primary database to obtain peer-reviewed literature and other academic texts; while general web searches produced policy documents, industry design standards, practitioner-based resources, and case studies. Keywords were used in combination to search the sources, including: Inclusive Design, Universal Design, architecture, justice, health, health equity, inclusion, diversity, and built environment, among others. Ultimately, forty-four sources were selected for this review that range in focus; specific design approaches (i.e., Universal vs. Inclusive Design) are specified as needed.

CONNECTING THE SOCIAL DETERMINANTS OF HEALTH AND INCLUSIVE DESIGN

The Social Determinants of Health (SDOH) is a critical framework for exploring health equity across five key factors – *Economic Stability, Education Access and Quality, Health Care Access and Quality, Neighborhood and Built Environment,* and *Social and Community Context.* Issued by the Centers for Disease Control and Prevention (CDC), the determinants are estimated to affect a wide range of health risks and quality of life outcomes,¹⁰ and as such are critical to ensuring health equity across diverse populations. Limited research exists to explore the relationship between Inclusive Design and health equity. Findings from literature to be further explored in this paper, however, show linkages between Inclusive Design and each of the five SDOH. These connections suggest that Inclusive Design plays a role in impacting critical aspects of both health and health equity. The following sections outline examples from scholarship and praxis connecting Inclusive Design with each SDOH. By exploring Inclusive Design in this capacity, this paper paves a foundation for continued conversations about the role Inclusive Design can play in addressing health inequities across systems, programs, policies, and the built environment.



Figure 6. The five Social Determinants of Health adapted from CDC Healthy People 2020.¹¹

Economic Stability

Economic stability sets a critical foundation for building a healthy life, both in terms of finding and maintaining steady employment. In the United States, Black workers are twice as likely to experience unemployment than White workers $(6.4\% \text{ vs } 3.1\%)^{12}$ and people with disabilities experience double the unemployment rates of people without disabilities (12.6% vs 7.9%).¹³ The application of Inclusive Design can facilitate more equitable processes of securing and maintaining employment. As an example, the U.S. Department of Labor cites the utility of Universal Design in the development of workplace communications, practices, and systems in the interviewing process to acknowledge differences in ability, skill levels, and personal backgrounds.¹⁴ In the book *Building for Everyone:* Expand Your Market with Design Practices from Google's Product Inclusion Team author Annie Jean-Baptiste provides insight into Google's recent adoption of Inclusive Design principles across human resources programs and employee development pathways.¹⁵ Microsoft has similarly committed to elevating Inclusive Design as a product development method that lauds employee diversity as a "resource for better designs."¹⁶ In these examples, employee differences are not only accommodated but celebrated, demonstrating how applications of Inclusive Design can improve not just job security but also job quality, an emerging trend in workforce development.¹⁷ As the United States and the rest of the world continue to rebuild labor and employment opportunities in the wake of COVID-19, Inclusive Design can help to create environments that truly support a diverse workforce, and in turn advance health equity.

Education Access and Quality

Access to quality education is a fundamental pillar of life; yet the United States continues to struggle with significant and systemic educational inequality.¹⁸ One of the more notable applications of Inclusive Design to address inequities in education is Universal Design for Learning. First developed in the 1990s, Universal Design for Learning (UDL) is an education framework that accounts for variances in cognitive abilities, languages, and learning styles, among other student differences. The UDL Guidelines reflect principles of Inclusive Design that are centered on guiding practices that can be adopted across disciplines through a transparent, community-oriented process.¹⁹ UDL has been shown to promote excitement in learning, foster ownership in learning, and encourage deeper learning for both students with and without disabilities.²⁰ Research also suggests that UDL supports both

academic learning and social/emotional aspects of learning for English Language Learners.²¹ Effective pedagogies rooted in Inclusive Design are one factor that can support access to quality education to ensure a bright and healthy future for all students.

Health Care Access and Quality

Expanding access to quality health care is undoubtedly an important step for addressing health disparities. Health communication, or the delivery of clear messaging and services to patients, is a key objective for ensuring health equity, particularly for marginalized populations.²² Inclusive Design has played a critical role in informing the development of healthcare programs and systems to improve health communication. As an example, Universal Design was used to develop inclusive Consumer Assessment of Health Plans Study (CHPS) surveys in the United States to more effectively assess patient healthcare experiences across ailment and disability.²³ More recently, Universal Design was used in the development of an assessment tool for healthcare facilities to ensure usability, wellbeing, and social inclusion for all patients.²⁴ Beyond application to systems and programs, Inclusive Design has also been proposed as a solution to strengthen direct patient services for traditionally underrepresented groups. Such challenges facing healthcare services for LGBTQ+ older adults were further researched in Ireland, finding that inclusive, person-centered approaches would more effectively address the needs of this population.²⁵ Both in terms of systems and direct patient care, Inclusive Design has a critical role in advancing health care access and quality for all.

Social and Community Context

Social and Community Context prioritizes people's relationships, sense of safety, and sense of belonging as a key component to overall health and wellness.²⁶ While initially rooted in accessible design, newer schools of thought have positioned Inclusive Design to promote equitable, healthy, and usable environments for all. To illustrate this point, the IDEA Center at the University at Buffalo recently issued an updated definition of Universal Design as, "a process that enables and empowers a diverse population by improving human performance, health and wellness, and social participation."²⁷ This broadening in scope has paved the way for the application of Inclusive Design approaches across disability, culture, religion, gender, language, homelessness, and other personal identities.²⁸ Specifically, tenets of both Universal Design and Inclusive Design have been explored to address LGBTQ+ inclusion²⁹ and "collective access" across intersectional identities of gender, disability, and race.³⁰ While still an emerging trend, the broadening of Inclusive Design to create environments where everyone feels safe, welcome, and productive will be pivotal in the pursuit of greater health equity.

Neighborhood and Built Environment

While Inclusive Design of policies, programs, and systems has helped to influence the SDOH including *Economic Stability, Education Access and Quality, Health Care Access,* and *Social and Community Context,* arguably the most seemingly aligned opportunity to apply Inclusive Design is in the context of *Neighborhood and Built Environment.* Inclusive Design has a long history in the field of architecture; arguably one of the most proliferated Inclusive Design documents – the Universal Design Guidelines – was developed in 1997 by a consortium of architects and design professionals at the Center for Universal Design at North Carolina State University.³¹ Inclusive Design has played a critical role in advancing accessible and usable environments, programming, and products for people with disabilities in the United States and worldwide.³² Additionally, Inclusive Design processes can serve to address "a broad range of users, including children, older adults, people with disabilities,

people of atypical size or shape, people who are ill or injured, and people inconvenienced by circumstance."³³

Though *Neighborhood and Built Environment* serves as a SDOH, there is little information on how equity ties into factors of the built environment. Illustrating this point, none of the baseline goals or objectives outlined by the CDC to "create neighborhoods and environments that promote health and safety" include Inclusive Design strategies.³⁴ There is a missed opportunity to inform design strategies of our buildings, spaces, and communities with greater equity embedded within them through Inclusive Design. In turn, an increased adoption of Inclusive Design can further support pathways to greater health equity. The following section identifies opportunities and outlines recommendations for addressing health equity through Inclusive Design of the built environment.

OPPORTUNITIES FOR ADVANCING HEALTH EQUITY THROUGH INCLUSIVE DESIGN OF THE BUILT ENVIRONMENT

There are many pathways for advancing health equity through Inclusive Design of the built environment. Based on the literature reviewed, four key opportunities are shared for consideration.

Opportunity #1: Inclusive Design informs integrative design processes.

One key strategy to achieving successful health equity initiatives is to ensure they are communitydriven.³⁵ In the context of the built environment, community-centered projects – often referred to as participatory design – are gaining traction but can be fraught with challenges. Participatory design has been criticized for failing to truly reflect a diverse range of perspectives and lived experiences.³⁶ Furthermore, research suggests that power imbalances often exist between designers - who are typically seen as "leaders" of the process - and community members, who often must relent to preconceived ideas driven from a top-down approach.³⁷ Inclusive Design can enrich participatory design processes both by ensuring a wide representation of voices and perspectives, and by leveraging all forms of human diversity to inform design.³⁸ Examples of participatory design processes that reflect philosophical tenets of Inclusive Design include the LGBTQ Futures Projects, which aimed to explore how LGBTQ people experience community and technology in rural places;³⁹ and the involvement of First Nation communities in Canada to develop culturally appropriate housing portfolios.⁴⁰ As integrative design processes continue to grow in popularity, Inclusive Design can inform equitable and meaningful engagement to ensure the development of products, buildings, and spaces are truly beneficial and healthy to all.

Opportunity #2: Inclusive Design brings an equity lens to healthy and sustainable building strategies.

Just because a building is healthy or sustainable, does not mean it is also inclusive. Currently, building rating standards such LEED, WELL Building, and Living Building Challenge reference Inclusive Design as (most often) optional strategies to consider in the pursuit of healthy and sustainable buildings. This short-sighted approach relegates Inclusive Design as an afterthought in achieving building performance and diminishes the importance of inclusive environments. Rather, Inclusive Design can be adopted as a paradigm that brings an equity lens to healthy and sustainable building strategies. Case study research conducted on the intersectionality between these approaches found that, in certain instances, following Universal Design principles led project teams to crosscutting solutions that achieved both accessibility and sustainability goals.⁴¹ Exploring built environments through Inclusive Design will also highlight that not all healthy and sustainable building strategies will impact users equally. As an example, ample lighting fixtures meant to address mental

health and wellness in most populations may prove challenging for those with seizure disorders or autism.⁴² Adopting an Inclusive Design paradigm will ensure that competing priorities and needs of all users are sufficiently addressed in the pursuit of healthier and more sustainability buildings.



Figure 7. Adopting an Inclusive Design paradigm brings an equity lens to healthy building and sustainability strategies. Source: Authors.

Opportunity #3: Inclusive Design supports urban planning initiatives.

Thoughtfully designed urban places can improve healthy behaviors and social engagement, increase access to food markets, and improve walkability, along with other outcomes that can critically impact health equity.⁴³ Inclusive Design is an emerging trend in the fields of urban planning and landscape architecture. In 2018, the American Society of Landscape Architects (ASLA) introduced Universal Design principles to ensure safe and usable neighborhoods, streets, parks and plazas, playgrounds, and gardens. The guidelines underscore the importance of Inclusive Design: "If we want everyone to participate in public life, we must design and build an inclusive public realm that is accessible to all. Public life can't just be available to the abled, young, or healthy."⁴⁴ Furthermore, Inclusive Design

strategies have been projected to help reduce barriers in the built environment and to positively impact performance, health and wellness, and social participation in an effort to create more vibrant and cohesive communities.⁴⁵ As urban planning efforts continue to expand, Inclusive Design can continue to help reduce barriers in urban environments and places of public access, to in turn promote health equity.

Opportunity #4: Inclusive Design informs safety and disease prevention efforts.

Disease reduction and prevention is critical to addressing health inequalities, particularly as people return to workplaces and places of public accommodation post-COVID-19. The application of Inclusive Design has long-promoted safe and navigable spaces that in turn reduce injury and illness.⁴⁶ As health and wellness emerge as a priority across Inclusive Design initiatives, so too do design strategies that seek to promote active design, prevent obesity, and support general healthy behaviors. This initiative is exemplified in the *Universal Design Guidelines New York 2*, a city-issued resource that puts forth design recommendations that support physical engagement for all as an aspect of Universal Design – including access to recreation facilities, fitness equipment, and sports programming.⁴⁷ Additionally, Universal Design has been used to inform the development of Universal Safety Design principles and guidelines as a way to bring basic safety standards to all workers.⁴⁸ Universal Design has also been cited as a key strategy for creating equitable and healthy environments post COVID-19 for its capacity to address emerging areas of critical interest including neurodiversity, mental health, technology, and transportation.⁴⁹ Inclusive Design can inform approaches that reduce disease and promote safety, two critical components of health equity.

DISCUSSION AND CONCLUSION

This paper aims to elevate awareness of Inclusive Design's applicability across the five Social Determinants of Health, with a specific focus on its role in advancing health equity through the design of the built environment. Overlooking Inclusive Design as a key strategy for addressing health equity in the context of buildings, spaces, and communities is a missed opportunity; and yet, Inclusive Design has not achieved mainstream status as has sustainability or healthy building.⁵⁰ This is particularly salient in the United States where Inclusive Design is not legislated, unlike accessible design, and practitioners erroneously see the approach as burdensome, costly, and unattractive.⁵¹ While efforts are burgeoning to elevate Inclusive Design in line with building performance through the adoption of new standards in LEED, WELL Building, and the Living Building Challenge, such efforts are often optional offering little incentive for adoption. This paper raises four opportunities for consideration to underscore the important connection between Inclusive Design and health equity. Specifically, the opportunities explored here included Inclusive Design's role in 1) informing more integrative design processes; 2) bringing an equity lens to healthy and sustainable building strategies; 3) inspiring more equitable urban planning initiatives; and 4) informing safety and disease prevention efforts. Findings from this exploratory paper are intended to serve as a foundation to support future research efforts and practical applications of Inclusive Design to advance health equity.

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PHYSICAL DESIGN OF SUPPORTED ACCOMMODATION FOR PEOPLE WITH MENTAL HEALTH PROBLEMS AND INTELLECTUAL DISABILITIES: A SCOPING REVIEW

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INTRODUCTION

Evidence suggests that the built environment can have an impact on physical and mental health¹ and that there exists a relationship between wellbeing and architectural design². Following

work by Ulrich who identified the importance for health of interaction with the natural environment, studies further explored the relationship between health and the built environment³. Recently, there has been a focus on design of inpatient facilities with key design features identified for improving quality of life and health outcomes⁴. This may be particularly important for people with mental health problems and intellectual disabilities who are more likely to have significantly poorer health than the general population and experience a range of co-morbidities⁵.

Research has suggested that supported accommodation has the potential to improve quality of life outcomes for people with mental health problems and intellectual disabilities⁶. Despite this, there is a lack of research into the physical design of supported accommodation and features that could potentially have an impact on physical and mental health outcomes for service users.

This paper aimed to review physical design of supported accommodation for people with mental health problems and intellectual disabilities. The objectives were to: 1) examine the scope of the evidence in relation to physical design of supported accommodation; 2) identify physical design features or qualities and 3) identify the impact of the physical design on the health and wellbeing of service users.

METHODS

Search

Searches were conducted across seven databases: Medline, PsycINFO, Embase, CINAHL, Scopus, Web of Science and RIBA. Search terms included supported accommodation OR supported housing AND physical design OR built environment OR architecture. No timespan limits were imposed and reference lists of all included papers were hand searched. No limits were imposed with regard to study design.

Eligibility Criteria

Studies were included if they met the following criteria; 1) conducted in a supported accommodation setting; 2) report at least one measure of physical design; 3) mean age of participants is over 18 years; 4) adults with mental health problems and/or intellectual disabilities and 5) full text and available in English. Studies that did not meet these criteria were excluded.

Screening

The search identified 6995 papers. As a result of screening by title and abstract, 5956 papers were excluded. Forty-five full text articles were screened for eligibility by a single reviewer and a random sample of papers were assessed by two further reviewers. Eight papers were subsequently included in this review.

RESULTS

Overview of Included Papers

Studies were conducted in Sweden (n=5), USA (n=2) and Canada (n=1), with sample sizes ranging from 17 to 670 participants. The total number of participants across studies was 1,193. All studies included mixed genders. The setting for all included studies (n=8) was supported accommodation. The majority of studies were conducted in congregate supported accommodation (n=5) and the remaining studies were conducted in independent supported accommodation (n=3). All studies reported on at least one aspect of physical design of supported accommodation and all participants had mental health problems. None of the studies reported if participants also had intellectual disabilities. Five studies used a cross-sectional design⁷; one study used interviews⁸; one study was a longitudinal cohort study⁹ and one study used photo elicitation¹⁰.

Physical design features

Common Areas

Four studies reported on the design of common rooms in supported accommodation. Piat et al. used photo elicitation and found that participants' photographs reflected their appreciation for amenities in their apartments which included common rooms¹¹. Common rooms were portrayed by participants as places to relax and participate in leisure activities. Participants also reported that they enjoyed the freedom of being able to choose whether and when to use common areas. Johansson and Brunt compared the common areas of purpose built and non-purpose built supported accommodation and reported that Scandinavian interiors work well in common areas with the same structure as a home whilst accommodation that is more institutional benefits from soft furnishings to feel less sterile¹². Marcheschi et al. suggested that common areas need to be more open and connected allowing users to

Marcheschi et al. suggested that common areas need to be more open and connected allowing users to circulate within the space. Findings also suggested that common areas should have as much natural sunlight as possible as this may have a positive impact on the use of the environment¹³. Another study found that common areas were institutional in design and that difficulties exist in designing a therapeutic environment which feels homely¹⁴.

Private Areas

Three studies reported on the design of private rooms. Johansson and Brunt reported that desirable design features of high quality supported accommodation included more features to support residents' autonomy: bathroom and kitchen; spaces for sleeping and socialising; higher environmental quality including light, noise, colour and temperature. Furthermore, ability to control the environment within private areas was important including opening windows; choosing wall colours and furniture¹⁵.

Piat et al. showed that service users valued their own private space to retreat from others and enjoyed having their own front door, bedroom, kitchen and living space. Autonomy in relation to private areas was also important for participants to customise their own space¹⁶. Bengtsson-Tops et al. also reported that participants valued their private space for retreating but also for activities including exercising and watching TV¹⁷.

Outdoor Spaces

Half of the studies reported on the design of outdoor spaces. Marcheschi et al. reported that layout, proximity and presence of furniture were important features of outdoor spaces¹⁸. Johansson and Brunt explored the design of outdoor spaces in purpose built and non-purpose built supported accommodation and found that both provided access to sunny outdoor spaces; however the purpose built facilities were rated significantly higher. Design features that were important for outdoor spaces were the use of soft materials, a stimulating environment and being well maintained¹⁹. Marcheschi et al. reported that the presence of gardens, trees and flowers, outdoor furniture and areas for privacy were important to encourage service users to utilise the space. Participants also reported that traffic nearby and lack of greenery were negative features of outdoor spaces²⁰. Furthermore, Piat et al. reported that outdoor spaces were therapeutic and features such as flowers were calming and healing for service users²¹.

Homelike Environment

A homelike environment was a consistent theme across studies. Piat et al. found that a homely environment was defined by ownership of objects which personalised a resident's space. The opportunity to customise their living spaces with wall art and painting the walls was symbolic of their autonomy and an opportunity to create an environment which feels less institutional²². Johansson and Brunt found that service users often brought their own furniture and decorations which allowed them to create their own space. Furthermore, findings suggested that interiors of supported accommodation should create a welcoming environment that incorporates a spatial structure that resembles a home. Findings also showed that the addition of name plates, door mats and letter boxes could help make the environment more homelike²³.

Health and Wellbeing

The majority of studies investigated the effect of physical design on health and wellbeing (n=5). Wright and Kloos found that participants' perception of their housing environment was associated with wellbeing outcomes including psychiatric distress, recovery, residential satisfaction and adaptive functioning. In addition, findings showed that although physical features of their apartment had a relationship with wellbeing outcomes, participants' perception of their surrounding neighbourhood was a strong predictor of wellbeing²⁴. Similarly, Marcheschi et al. found that perceived physical and social environment qualities of supported accommodation accounted for approximately 32% of variation in perceived quality of life²⁵.

Johansson and Brunt reported that high quality supported accommodation was characterised by clear demarcation between private and common areas, opportunities for independent living, common room facilities, private rooms and higher environmental quality. Moreover, higher quality physical environment characteristics were more likely to be perceived as homelike and foster positive psychosocial processes between the physical environment and mental health. Findings also showed that physical environment qualities can have an effect on perceptions of social support, perceived control and restoration²⁶. Similarly, Bengtsson-Tops et al. found that participants valued having their

own private space to rest and retreat from others which helped them to feel calm and was a positive distraction from psychiatric symptoms²⁷.

Harkness et al. investigated the relationship between physical design and mental health with findings showing that low quality buildings that were in need of repair being associated with a 58% increase in residential instability and a 28% increase in community-based mental health service costs. Older buildings were also associated with poorer mental health outcomes with every additional 10 years of a property's age increasing the probability of hospitalisation by 16% whilst additional amenities in supported accommodation were associated with an 11% reduction in community-based mental health service costs. Furthermore, every 10% increase in the proportion of residents with mental illness was associated with a 5.5% decrease in residential instability²⁸. Wright and Kloos highlighted the importance of neighbourhood social climate as a predictor of wellbeing outcomes for people with mental illness, findings showed that having other people with mental illness in close proximity was related to wellbeing for this population²⁹.

Social Interaction

The physical environment of supported accommodation was reported as an influencing factor for social interaction in the majority of studies (n=5). Marcheschi et al. found that there were more positive social interactions among service users than between service users and staff. Social interactions between service users were likely to occur in dining areas, corridors and outdoor environments. Layout, configuration and furniture placement were important predictors of social interaction among service users and staff. For example, the layout and proximity of outdoor environments which were well-kept and with outdoor furniture facilitated better social interactions between service users and staff. Social interactions between service users often took place around dining tables further reinforcing the importance of furniture placement³⁰.

Another study found that perceived physical and social environment accounted for variability in quality of life in service users. Findings highlighted the importance of

features such as furniture and private areas for supporting social interactions between service users³¹. Similarly, Bengtsson-Tops et al. found that the physical environment could facilitate social interactions among service users as they enjoyed being able to use their own space for socialising with friends or communal spaces such as the dinner table, smoking area or laundry room for conversations with others³². Wright and Kloos found that physical attributes of supported accommodation can facilitate social interaction such as having others with mental illness within the same building³³. Piat et al. reported that features such as common and recreation rooms were meaningful to foster social connectedness and to decrease the likelihood of loneliness and isolation³⁴.

Location of Supported Accommodation

Four studies reported on neighbourhoods where supported accommodation was located. Harkness et al. found that space surrounding supported accommodation that was not used for residential buildings was associated with a 15% reduction in community-based mental health service costs. Moreover, findings suggest that the physical quality of a neighbourhood has an impact on mental health outcomes with neighbourhood problems being associated with 26% higher community-based mental health services costs and a 79% increase in service costs if hospitalised³⁵. Similarly, one of the distinguishing features of high or low quality supported accommodation as categorised by Marcheschi et al. was perceived physical quality of the location. Findings showed that high quality accommodation was often located in the suburbs which afforded residents opportunities to access

green spaces whilst low quality facilities were more often in urban locations which provided residents with better access to community services³⁶.

Wright and Kloos also highlighted the importance of the neighbourhood suggesting that the area should have good lighting, footpaths, transportation and community accessibility³⁷. Johansson and Brunt reported that location of supported accommodation was often dependent on urban planning and that stigmatisation around these types of facilities means they are often opposed in quieter rural areas. The urban location of supported accommodation meant high levels of traffic which reduced usability of outdoor spaces³⁸.

DISCUSSION

This review examined the scope of the literature on physical design of supported accommodation and identified physical design features. Furthermore, this review has identified the impact these design features can have on wellbeing and social interaction of residents. The key findings show that features including: communal spaces for socialising; private areas that can be personalised; well-kept outdoor spaces; and a home like environment, are important physical design features.

Autonomy and choice are directly related to mental health³⁹. A consistent theme of studies was the autonomy to personalise the environment so that service users had ownership over their own space. Service users also valued being able to choose when to access common areas or retreat to their own spaces. Liddicoat et al. found that allowing flexibility in the environment such as choice of lighting and furniture can empower service users to have agency over their own healthcare⁴⁰. Furthermore, Harrison et al. concluded that increasing autonomy and choice for service users in supported accommodation facilitates recovery of people with severe mental illness⁴¹. Ulrich's theory of supportive design suggested that healthcare environments can alleviate stress and promote wellness if they are designed to foster a sense of control and create positive distraction⁴². For example, providing service users with opportunities to personalise their own space with pictures or decorations could foster both control and positive distraction. Increasing autonomy by involving service users in the planning and design process of supported accommodation could enable them to tailor the physical environment to their needs and thereby facilitate recovery and improve outcomes.

Neighbourhood quality has also been associated with better mental wellbeing⁴³. Research has investigated the relationship between mental health and the built environment of neighbourhoods⁴⁴. Physical attributes of the neighbourhood environment and perceived neighbourhood problems have been associated with poor mental health⁴⁵. A number of studies in this review reported on the location of supported accommodation with neighbourhood quality, traffic and access to green spaces being consistent themes. These findings were corroborated by Croucher et al. who found that high levels of traffic and disrepair of the built environment have been shown to have a negative impact on mental health⁴⁶. Harkness et al. found that supported accommodation located in areas with non-residential land uses and a higher proportion of rented properties was associated with reduced mental health care costs as these areas were perceived as more diverse and with more fluid populations which enabled people with mental ill health to feel anonymous and less stigmatised⁴⁷. Bond et al. also reported that neighbourhoods were significantly associated with positive mental wellbeing with features such as quality of amenities, attractive buildings and a peaceful environment being influencing factors⁴⁸. Given the potential impact of location and neighbourhood during the planning process.

It is well reported that the physical environment can have an effect on health and wellbeing⁴⁹. Furthermore, a number of studies have investigated the physical design of inpatient facilities⁵⁰. Consistent with previous research, the majority of studies reported that the physical design of

supported accommodation had an impact on health and wellbeing of service users. Common physical design factors that influenced health and wellbeing included; homelike environment, neighbourhood quality, private, communal and outdoor spaces. These findings are corroborated by Jamshidi et al. who reported that layout, materials, room features and nature had an impact on health and patient outcomes⁵¹. The World Health Organisation's Mental Health Action Plan recognises that mental health is an integral part of wellbeing and the overall goal includes promoting mental wellbeing, providing care and enhancing recovery⁵². Thus, given that it is evident that the physical environment can impact physical and mental health, it may be appropriate to adapt design features of supported accommodation to promote wellbeing and facilitate recovery.

It is evident that physical design is an influencing factor for social interaction and was a consistent theme across the studies in this review. Factors that were related to social interaction included layout of common areas, furniture arrangement and provision of furniture in outdoor areas. These findings are consistent with Evans who reported furniture arrangement can promote social interaction such as chairs facing each other or arranged around a table⁵³. Moreover, the link between social interaction and mental health is well established⁵⁴. Further examination of physical design to facilitate social interaction in supported accommodation may be warranted to promote recovery and improve health outcomes for service users.

Overall, it is evident that there is a lack of research on the physical design of supported accommodation for people with mental health problems and intellectual disabilities. This may be a neglected area of research due to the lack of joined up thinking between architects, planners, builders and housing associations; lack of involvement of service users and difficulties in recruiting hard to reach populations to participate in research; lack of resources; difficulties in effecting policy change and fragmented service delivery. There remains many barriers to implementing physical design interventions to improve health outcomes for service users.

STRENGTHS AND LIMITATIONS

Papers were systematically searched using electronic databases and were reviewed by two additional reviewers prior to inclusion. Limitations include the small number of studies eligible for inclusion and only full text articles that were available in English were included.

CONCLUSION

This review examined the scope of the evidence in relation to physical design of supported accommodation, identified physical design features and qualities and the impact of these on health and wellbeing of service users. Results indicate that there is a dearth of evidence on the physical design of supported accommodation. However this review did identify factors that may be successful in improving physical and mental health outcomes and facilitating recovery. These include: private rooms which support autonomy with opportunities for personalization; common areas with natural light and homely features; outdoor spaces with greenery and furniture; located in good neighbourhoods and community accessibility. Further research is required to create a robust evidence base in order to inform the planning, design and building of supported accommodation.

NOTES

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- ¹⁴ Marcheschi et al., Physical Environment Qualities, 128.
- ¹⁵ Johansson and Brunt, The Physical Environment, 223.
- ¹⁶ Piat, (Em)placing Recovery, 73.
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- ²⁴ Wright and Kloos, Housing Environment, 80.
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- ²⁸ Harkness et al., The Cost-effectiveness of Independent Housing, 1343.
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- ³³ Wright and Kloos, Housing Environment, 83.
- ³⁴ Piat, (Em)placing Recovery, 73.

³⁵ Harkness et al., The Cost-Effectiveness of Independent Housing, 1342.

³⁶ Marcheshi et al., Physical Environment Qualities, 130.

³⁷ Wright and Kloos, Housing Environment, 85.

³⁸ Johansson and Brunt, The Physical Environment, 228.

³⁹ Lorna Moxham "Where you Live and Who you Live with Matters: Housing and Mental Health," Journal of Prevention and Intervention in the Community 44, no. 4 (2016): 247-257, doi: 10.1080/10852352.2016.1197720. ⁴⁰ Liddicoat et al., Principles for Designing the Built Environment, 915.

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⁴³ Lyndal Bond et al. "Exploring the Relationships between Housing, Neighbourhoods and Mental Wellbeing for Residents of Deprived Areas," BMC Public Health 12, no. 48 (2012): doi: 10.1186/1471-2458-12-48.

⁴⁴ Sandro Galea et al. "Urban Built Environment and Depression: A Multilevel Analysis," Journal of Epidemiology and Community Health 59, no. 10 (2005): 822-827, doi: 10.1136/jech.2005.033084; Giulia Melis et al. "The Effects of the Urban Built Environment on Mental Health: A Cohort Study in a Large Northern Italian City," International Journal of Environmental Research and Public Health 12, no. 11 (2015): 14898-14915, doi: 10.3390/ijerph121114898.

⁴⁵ Hilary Guite et al. "The Impact of the Physical and Urban Environment on Mental Well-Being," Public Health 120, no. 12 (2006): 1117-1126, doi: 10.1016/j.puhe.2006.10.005; Richard Mitchell et al. "Neighbourhood Environments and Socioeconomic Inequalities in Mental Well-Being," American Journal of Preventive Medicine 49, no. 1 (2015): 80-84, doi: 10.1016/j.amepre.2015.01.017.

⁴⁶ Karen Croucher et al. "Health and Physical Characteristics of Urban Neighbourhoods: A Critical Literature Review" (final report for Glasgow Centre for Population Health, Glasgow, Scotland, March 2007).

⁴⁷ Harkness et al., The Cost-Effectiveness of Independent Housing, 1343.

⁴⁸ Bond et al., Exploring the Relationships, 10.

⁴⁹ Hoisington et al., Ten Questions, 59; Janet Ige et al. "The Relationship between Buildings and Health: A Systematic Review," Journal of Public Health 41, no. 2 (2018): 121-132, doi: 10.1093/pubmed/fdy138.

⁵⁰ Ulrich et al., Psychiatric Ward Design, 55; Jeffrey Borckardt et al. "Systematic Investigation of Initiatives to Reduce Seclusion and Restraint in a State Psychiatric Hospital," Psychiatric Services 62, no. 5 (2011): 477-483, doi: 10.1176/ps.62.5.pss6205 0477.

⁵¹ Saman Jamshidi et al. "The Effects of Environmental Factors on the Patient Outcomes in Hospital Environments: A Review of the Literature," Frontiers of Architectural Research 9, no. 2 (2020): 249-263, doi: 10.1016/j.foar.2019.10.001.

⁵² "World Health Organisation Mental Health Action Plan," World Health Organisation, accessed 14th January, 2021, https://www.who.int/publications/i/item/9789241506021.

⁵³ Gary Evans "The Built Environment and Mental Health," Journal of Urban Health 80, no. 4 (2003): 536-555, doi: 10.1093/jurban/jtg063.

⁵⁴ Peggy Thoits "Mechanisms linking social ties and support to physical and mental health," Journal of Health and Social Behavior 52, no. 2 (2011): 145-161, doi: 10.1177/0022146510395592; Nikolina Jovanovic et al. "How to design psychiatric facilities to foster positive social interaction - A systematic review," European Psychiatry 60, (2019): 49-62, doi: 10.1016/j.eurpsy.2019.04.005.

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ADVANCING EUDAEMONIC DESIGN AS AN APPROACH TO AMPLIFY HEALTH AND WELL-BEING IN THE BUILT ENVIRONMENT

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INTRODUCTION

Designing for health in the built environment has been a subject of interest since Florence Nightingale advocated for increased natural ventilation as a public health approach¹. Building health as a proactive business strategy² has accelerated over the past decade to become a necessity in the context of the COVID-19 pandemic³. Buildings are now assessed based on their capacity to satisfy physical, mental, and social determinants of health⁴ as well as elevate occupant experience and well-being. However, despite this increasing importance, further work is required to identify effective ways of achieving these aspirations and delivering Fromm's "vivere bene"⁵.

Framed through the neo-Aristotelian concept of Eudaemonia, a term synonymous with human flourishing, this paper proposes "Eudaemonic Design" as an approach to designing for optimal health in built environments via eudaemonic well-being⁶. The authors discuss the theoretical foundations of eudaemonic design before applying the model to a detailed case study that considers the home's prioritized importance since the onset of COVID-19 and population ageing-related demands—one focused on supporting ageing-in-place older adults—to demonstrate potential utility. By employing a unique combination of virtually conducted methods and co-design, built on theory and practice, the research team presents this study as a practical examination of the theorized eudaemonic design concept, in preparation for the future creation of a formalized eudaemonic design model and set of principles.

Usage of this eudaemonic design approach has the capacity to ensure that optimal physical, mental, and social health needs are proactively identified and pragmatically satisfied and encourage occupants of a space to be(come) their intrinsically motivated best selves. In this way, eudaemonic design promotes flourishing health and well-being in the built environment and in society⁷. The paper concludes by identifying potential applications, opportunities for design approach validation, and areas for future research.

DESIGNING FOR HEALTH IN THE BUILT ENVIRONMENT

It has been estimated that ninety-eight percent of people spend ninety percent of their lifetimes in buildings⁸. The built environment plays an important role in formulating healthy life-enabling conditions or creating ill life-disabling ones⁹. Put simply, because the built environment "can make you sick or keep you well"¹⁰, buildings can be designed to support occupant health and well-being.
Indeed, the built environment "should contribute to a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity"¹¹. The first century BCE Roman architect and engineer Vitruvius was among the first to argue this connection through his observation, "the architect should [have] knowledge of the study of medicine [to assure the healthiness of a dwelling]"¹².

Despite this connection, until relatively recently the extensive academic and grey literature on the impact of the built environment on health and health design in buildings focused on avoiding diseasogenic (life-disabling) rather than supporting salutogenic (life-enabling) circumstances. While further scholarship has been added since the onset of the global COVID-19 pandemic addressing disease vulnerability indoors, there has also been a concerted multidisciplinary research emphasis on proactive healthy architecture^{13,14,15} with a focus on design for both long-term prevention and protection¹⁶ and on comprehensive¹⁷, if not flourishing¹⁸, levels of health.

The World Health Organisation defines health as the absence of disease and a balanced state of physical, mental, and social well-being¹⁹. One way of conceptualizing this idea is via the work of Labonté²⁰ who suggests "to be healthy, one needs a sense of meaning or purpose in life, connection to others in community, and physical vitality or energy". As shown in Figure 1, while these three dimensions can occur independently, well-being is achieved through their integration. For example, the sense of meaning and purpose achieved through good mental health combined with social health results in a feeling of control over one's life and living conditions, while the vital energy experienced through good physical health combined with mental health facilitates the ability for an individual to engage in activities they enjoy. Finally, a combination of robust physical health and experiences of connectedness and community result in the enjoyment of good social relations.



Figure 1. Dimensions of health and well-being.²¹

Designing for individual aspects of physical, mental, and social health can result in generic approaches and underwhelming results, where certain health aspects are satisfied, and others are not. Failing to deliver equally on all three impacts the ability to deliver health outcomes or more importantly to create flourishing environments—those that move beyond being merely health-supportive and toward promoting better behaviours, encouraging improved physical, mental, and social activity, and motivating individuals to be(come) their best selves.

DESIGNING FLOURISHING ENVIRONMENTS

Flourishing health has roots in the concept of "Eudaemonia" (i.e., literally meaning "eu," good or healthy, and "daimon," true self). Eudaemonic interventions have been prevalent in the field of psychology over the past two decades²² when considering related ideals of flow²³, happiness²⁴, and general well-being²⁵. Unfortunately, until recently, they have been limited to cognitive psychology rather than pragmatic spatial applications.

Prompted by the psychological practices of inducing meaningful change for patients²⁶ and recognition of the importance of infrastructure to occupant health²⁷, contemporary built environment professionals and academics are beginning to examine ways of designing architecture for flourishing health and well-being²⁸. Although an important and progressive development, these efforts have focused on achieving subjective or hedonic well-being rather than eudaemonic well-being²⁹ and therefore do not necessarily support an holistic treatment of well-being, as they fail to fully capture complex notions of happiness and well-being³⁰. By contrast, a focus on eudaemonic well-being balances both objective and subjective considerations, enabling individuals to function at optimum capacity, and may result in a richer more virtuous perspective when conceptualizing designing for people's true best selves.

Designing for Eudaemonic Well-Being

The term eudaemonic well-being was popularised by Waterman³¹, who differentiated the concept from the hedonistic concept of happiness and focused on a broad self-realization-based (flourishing) interpretation³². The term was operationalised by Ryan and Deci in their Self Determination Theory (SDT), which provides guidance on how to satisfy both the basic psychological needs inherent in subjective well-being as well as the more holistic aspects of eudaemonic well-being.³³

Optimal wellness in the form of eudaemonia can only occur when humans are engaged and motivated for change. SDT explores this idea and defines what is needed to prompt motivation to enhance health. Research over the last decade has identified three fundamental needs that must be met for someone to feel motivated. As shown in Figure 2, the cornerstones of SDT are autonomy, competence, and relatedness^{34,35}. Autonomy engages feelings of having choice and control over the course of one's life, competence refers to being effective in one's activities and the experience of mastery, and relatedness is concerned with the need to experience connection and belongingness with others.

Through intrinsic motivation, SDT encourages individuals "to seek out novelty and challenges, to extend and exercise one's capacities, to explore, and to learn" so they innately and intrinsically want to do more³⁶. In this way, built environments that support intrinsic motivation can be regarded as flourishing spaces, suggesting that SDT can significantly contribute to the design of such environments. Thus, when autonomy, competence, and relatedness are designed for (or simply considered during physical or theoretical design), SDT can be a means to attain human flourishing³⁷.

Indeed, because "SDT aims to specify factors that nurture the innate human potentials entailed in growth, integration, and well-being, and to explore the processes and conditions that foster the healthy development and effective functioning of individuals, groups, and communities"³⁸ it can be used to understand people's needs and to design environments for those needs. As a result, environments designed via SDT can prompt experiences of Waterman's flourishing eudaemonic well-being and therefore be used as a means to design for eudaemonia.



Figure 2. Tenets of Self-Determination Theory (SDT)³⁹.

A Model to Guide Eudaemonic Design

Although there are clear differences between approaches that advocate designing for health and those that promote designing for a broader conceptualisation of well-being, we argue that there is significant potential for these approaches to be reconciled and combined to guide our proposed concept of eudaemonic design—an approach of designing for eudaemonic well-being with SDT to attain optimal health and well-being.

As shown in Figure 3 the application of SDT directly supports design for the three primary areas of health. For example, designing for autonomy encourages "feeling control over life and living conditions" to contribute to better-quality social and mental health). Similarly, designing for competence fosters the "ability to do things one enjoys," thereby improving mental and physical health. Finally, designing for relatedness allows for "enjoying good social relations," thus potentially promoting improvements in both social and physical health.

Most importantly, by designing for all three SDT aspects (autonomy, competence, and relatedness) alongside a focus on all three health dimensions (social, mental, and physical), it is more likely that an individual can attain overall eudaemonic well-being, the central focus of this model. This allows for design that specifically seeks to support overall human flourishing. Thus, this is the goal when we seek to design built environments that prompt people to be their best selves.



Figure 3. Eudaemonic design model.

Because most health-focused projects address large asset types (e.g., commercial office, healthcare), a simplified version of this model was proposed as a conceptual approach to guide enhanced workplace well-being⁴⁰. However, given the home's newly established prominence in our daily lives as both personal and professional space and the increasing recognition that "health is made at home,"⁴¹ a thoughtful understanding of what it means to design for home health so that these spaces not only represent us but also have the potential to encourage us to be our best selves is required. The remainder of this paper elaborates on our proposed eudaemonic design model to proto-test and ground-truth its practical application, referencing a health-based home design case study with older adults aged sixty-five to eighty, living alone, and wishing to age in place.

TESTING THE PRACTICAL POTENTIAL OF THE EUDAEMONIC DESIGN MODEL

While the shift toward a new home-focused lifestyle has impacted a majority of the population, some demographics felt the consequences more severely⁴². Given their high percentage of time spent at home⁴³, purported deeper connection to space⁴⁴, "loneliness epidemic" tendencies that were exacerbated by COVID-19⁴⁵, wide variety of needs⁴⁶, and design for all potential when co-designed with⁴⁷, older adults are an ideal focal population for testing the potential utility of the eudaemonic design approach.

The need to employ health-supportive design that allows older adults to enjoy good health and do the things they value⁴⁸ takes on increased urgency in the context of the growing size of this population⁴⁹ and their desire to age in place⁵⁰. However, "for older adults to age in place, their physical environment must be accommodating, health promoting, and affordable"⁵¹. Considering the population ageing-generated necessity for healthy ageing in place housing, there is a need to design for this group to help curate a home space that allows them to happily and healthily "[Age] in the Right Place"⁵².

The Phased Research Approach

As depicted in Figure 4, this study adopted a three-phased approach, which employed a combination of virtually conducted convergent interviews⁵³, care-full cultural probes⁵⁴, and design futuring-focused non-solutionist⁵⁵ co-design⁵⁶ workshops. The following discussion outlines the purpose and focus of each phase, the key findings and observations from data collection, and the resulting analysis that support the potential utility of the proposed model.



Figure 4. Research approach.

Phase 1

The first phase focused on exploring human-space interrelationships by investigating older adult participants' conceptions of and connections to past, present, and future homes. The team explored older adult participants' concepts of past, present, and future home; captured notes, photographs, and drawings depicting relationships to current homes and contents; and posed questions on how to best design for Eudaemonia while initially probing for ideas on how to design for SDT's autonomy, competence, and relatedness.

Phase 2

The second phase introduced a group of Australian designers to the project. The designer and older adult groups came together in two virtual co-design workshops. In the first workshop, grouped participants were asked to collaborate to brainstorm ways to design for the overarching concept of eudaemonia—capturing all contributions before collectively prioritising their group's top three. The process continued as they brainstormed ways to design for autonomy, competence, and relatedness in turn. This was followed by a design futuring exercise on their ideal home. The outputs of activities were thematically analysed in preparation for a second workshop during which the output was reviewed, organized, and elaborated on by the same participants in preparation for future eudaemonic design principles creation.

Phase 3

Finally, in the third phase, all output was reviewed in a group interview that provided participants with the opportunity to identify the principles that they believed to be the most and least important, in their personal view, when designing for eudaemonia. These will be used to create a finalized set of principles for eudemonic design.

Analysis of the Eudaemonic Design Model

Waterman's flourishing Eudaemonic Well-Being is believed to "[embody] both objective and subjective components"⁵⁷. As SDT is the standard by which we design for eudaemonic well-being, it is important to understand people's objective and subjective interpretations of autonomy, competence, and relatedness needs before designing environments for those needs. One way to capture this combined perspective is via an approach that considers both qualitative and quantitative data.

The creative methods-based approach of this study garnered a significant depth and breadth of rich results, filled with articulated descriptions and beautifully visualized images. While all phases primarily consisted of qualitative data, phases two and three afforded some opportunity for quantitative data capture to interrogate prioritized perspectives of each participant. This is when the eudaemonic design model was deeply examined.

A Qualitative Approach

When participants were asked in phase one individual interviews if they thought that designing for autonomy, competence, and relatedness contributed to designing for physical, mental, and social health, many said yes and articulated how they felt that was so, referencing memories from homes of the past and present to elucidate their points.

When asked similar questions of how to design for these concepts in phase two's group workshops, they again provided well-thought-out ideas that were pragmatic and imaginative. However, it was difficult to align these diverse concepts directly to the specifics of the model itself and to assess the degree to which people felt these parallels were true.

A Quantitative Approach

Employing Zoom polls to prompt a quantitative understanding proved most effective when gauging the soundness of the model. Therefore, in addition to the qualitative design activities, quantitative polls were conducted during the phase two workshops to gauge conceptual alignment with the eudaemonic design model, though the model itself was never shared with the group to avoid skewed results. In the first workshop, the majority (80%) agreed that designing for autonomy, competence, and relatedness would address all three aspects of human health (physical, mental, and social). This figure rose to a compelling 94% in the second workshop, as shown in Figure 5. Therefore, consistent with prior research⁵⁸, this case study's findings suggest that realizing self-determination plays a vital role in ensuring the quality of life and health of older adults.

A follow-up poll, also depicted in Figure 5, examined the agreement between each SDT tenet and the overlapping health model terms of Figure 3 above. For example, 100% believed autonomy aligned well with "feeling control over life and living conditions." While fewer participants initially found direct correspondence for competence with "ability to do things one enjoys" (56%) and relatedness with "enjoying good social relations" (81%), group conversation resulted in strong belief that design done comprehensively for all three aspects of SDT was likely to yield positive holistic well-being outcomes, could be considered a means to achieve health, and should inform eudemonic design, thus aligning with the 94% value above and articulating the overall value of the model.



Figure 5. Initial participant perceptions of model alignment.

CONCLUSION

This paper explores designing for healthy environments at a time when COVID-19 is causing a paradigmatic shift toward understanding what constitutes healthy spaces, especially homes. The proposed model and case study clearly demonstrate the potential utility of adopting a eudaemonic design orientation in general and within a domestic setting in particular when seeking to design for optimal health and well-being. It also highlighted the extra-ordinary potential for eudaemonic co-design to recognize and address a variety of occupant needs in the design process.

Practically, there is potential to inform the architectural and technology design community in designing for eudaemonia in a positive psychology-based way, by promoting idyllic design futuring scenarios, empowering occupants, and engaging designers. Because of its foundation in SDT, eudaemonic design has widespread applicability potential, whether considering a variety of building types, occupants, and geographic location. Given this premise, adopting eudaemonic design approaches and applying them creatively via co-design with users in other built environments (e.g., healthcare, education) is also likely to yield positive findings. Future research, which validates this approach in a variety of settings and supports the development of a set of principles or guidelines to support the practical implementation of eudaemonic co-design, is also suggested.

NOTES

¹ Iddon, Chris. "Florence Nightingale"; Nightingale, *Notes on Nursing*.

² Jones Lang LaSalle (JLL), "A Surprising Way to Cut Real Estate Costs"; Allen and Macomber, "Why Are We Ignoring the 90 Percent?"

³ Barton, "Dr Joseph Allen"; Biron, "This Is How COVID-19 Is Changing the Design of Buildings."

⁴ World Health Organization (WHO), "World Health Organization Constitution."

⁵ Fromm, "Primary and Secondary Process in Waking and in Altered States of Consciousness."

⁶ Ryan and Deci, "On Happiness and Human Potentials."

⁷ Mikus, "Eudaemonic Design as a Symbiotic Methodological Approach to Human Health and Environmental Well-Being."

⁸ Allen and Macomber, "Why Are We Ignoring the 90 Percent?"; Roberts, "We Spend 90% of Our Time Indoors: Says Who?"

⁹ Jones et al., *Designing for Health & Wellbeing*.

¹⁰ Allen, "Your Building Can Make You Sick or Keep You Well," 1.

¹¹ Jones et al., *Designing for Health & Wellbeing*, 160.

¹² Vitruvius and Morgan, *The Ten Books on Architecture*.

¹³ Jones et al., *Designing for Health & Wellbeing*; Stevens, Petermans, and Vanrie, "Design for Human Flourishing."

¹⁴ Anthes, *The Great Indoors*; Allen and Macomber, *Healthy Buildings*.

¹⁵ Barton, "Dr Joseph Allen"; Biron, "This Is How COVID-19 Is Changing the Design of Buildings."

¹⁶ Kehrt, "The 'Healthy Building' Surge Will Outlast the Pandemic."

¹⁷ Rice, "A Health Map for Architecture."

¹⁸ Townshend, "Urban Design and Human Flourishing."

¹⁹ World Health Organization (WHO), *Mental Health*.

²⁰ Labonté, "Health Systems Governance for Health Equity," 64.

²¹ Ibid.

²² Deci and Ryan, "Hedonia, Eudaimonia, and Well-Being"; Ryan, Curren, and Deci, "What Humans Need"; Waterman, *The Best within Us*.

²³ Csikszentmihalyi, *Flow*, Csikszentmihalyi, *Flow and the Foundations of Positive Psychology the Collected Works of Mihaly Csikszentmihalyi.*

²⁴ de Botton, *The Architecture of Happiness*; Medina, "How the 'Happiness Industry' Is Changing Architecture"; Petermans, Cain, and Desmet, "Design for Health, Wellbeing and Happiness Manifesto"; Stevens, Petermans, and Vanrie, "Converting Happiness Theory into (Interior) Architectural Design Missions. Designing for Subjective Well-Being in Residential Care Centers."

²⁵ Jones et al., *Designing for Health & Wellbeing*.

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SOCIO-SPATIAL PRACTICES OF WELL-BEING: AUTHORS OF CIVIC ECOLOGIES

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INTRODUCTION

This article compiles research-by-design that documents farm practices which author incremental changes to their settings. In doing so, these practices transform the farms from commercially unviable sites to community assets. These assets, which are constituted in and embody social well-being, are achieved by individuals who work into the gap between the agency of a setting and Activities curated by the farm. The Office for National Statistics (ONS)¹ bases its qualitative assessment of well-being on a fine-grained analysis of the physical, cultural, and economic health of a local authority, weaving how well an individual lives across a weft of their ability to direct these to a good end. City farms that belong to and are part of the Federation of City Farms and Gardens (FoCFG)² are the result of a merger with Social Farms and Gardens (SF&G). Characteristically, city farms are situated on land which has little or no commercial value, and their ethical evolution and material development depends on generosity. Initiated at local level, they steward long-term community engagement of the physical, social, or cultural landscape with a desire to repair, in Jackson's terminology,³ and once ideals are established, they foster care (Puig de la Bellacasa⁴ and Esposito⁵) and the setting (from Krasny and Tidball)⁶ to form a centre from which to initiate ethical practices. In doing so, well-being is nurtured through tasks that establishing indigenous socio-spatial practices, thereby forming identities, refining networks, creating industries, and securing policy.

In this way, city farms are local, not-for-profit, uncertain microcosms of the city: microcosms because they practically and ethically interweave simple and complex *Activities* to achieve stability.⁷ They are 'uncertain' because their futures rely on the gifting of land and labour, where care is reciprocal with a community's formation. Well-being is an acclaimed experience of those working and volunteering on city farms, but the evolution, economy and policies are different on farms to those of the civic authorities. Thus, as institutions, they can provide insights into well-being which, unlike ONS accounts, help us appreciate what it is to "live well" and what is "good".

Focussing on two case studies - Oxford City Farm and Kentish Town City Farm - this article argues that the experience of well-being in a city farm setting is formed through concerns of 'care'⁸ for the material and social environment. The farm's practices initiate *Activities* the character of which is particular to the farm's locality and people. If, from Esposito, "care-in-common"⁹ is synonymous with "community" held together by task and gift, it follows that the socio-spatial practices delivered through care provide a diagnostic of well-being; furthermore, they hold potential to authorise such farms as civic ecologies within the city.

Forming a strategic framework to describe well-being as a practice-based activity, a framework referred to here as *Spheres of Action*¹⁰ (figure.1), this article draws upon two theories. Maslow's widely adopted Hierarchy of Needs pyramid discusses the psychology of human motivation, from simple needs of comfort to complex processes of self-activation.¹¹ And Krasny and Tidball's "resilience systems"¹² operationally discuss the stewardship of communities, from physical and social "repair" as "mending" to their complex socio-spatial practices involved in "policy" making. Together, these provide psychological and practical prisms to understand the farm's ethical engagement at the level of the individual, the community, and the institution. How the farm facilitates these connections within the framework, indicates its ability to motivate "care-in-common":¹³ what it is to "live well".



Figure 1. Diagram showing Spheres of Action - Drawing by author

Common to city farms are four *Spheres of Action*: governing, networking, making and mending. These operate, within a currency of "care", to repair the perceived socio-material absence or imperfection of a locality. The first sphere concerns itself with the act of "mending" the physical and social landscape; second, "making" with the development of skills and practices; third, "networking" with how skills and knowledge connect people with practices; and fourth, systems of "governing" with promoting policy beyond the periphery of the farm.

Influencing these *Spheres of Action* are local conditions: the *Agents*¹⁴ (site - socio-material conditions), the *Actors*¹⁵ (what individuals do), and the *Activities* (what the farm does). *Spheres of Action* are stimulated by the *Actors* engaging with the *Activities* – with projects¹⁶ set by the farm that serve to choreograph involvement across simple and complex socio-spatial practices. In this way, projects enable and validate the farm as a civic ecology, fostering an environment whereby an individual is free to pursue a 'good life' through local engagement within these uncertain microcosms. Arguing that the farm's practices are diagnostic of well-being, this being shaped by concerns for 'care', the practical methodology of this research forms three "Toolkits". The first, Toolkit 01, takes the form of measured drawings, photographs and diagrams charting the physical context and socio-

material conditions of the site as *Agents*. Toolkit 02, "what individuals do", is evidenced in a series of interviews capturing the journeys of *Actors*, their socio-cultural dispositions, skills, and involvement on the farm – journeys we will discuss in the form of "Tales". And last, Toolkit 03 documents *Activities* mobilised in projects through educational films and building projects. The latter serve to motivate the *Actors* across the *Spheres of Action*, so, whether the project *Activities* are small or large, the extent to which they engage the *Actors* in the *Spheres of Action* testify to the city farm's ability to engage and care for the setting and, by extension, for its community.

Placing the *Actors* centre stage, the thesis at the heart of the research addressed here develops a method that explores their motivation for working into the gap between the agency of a setting and *Activities* of the farm, arguing that their practices become diagnostic of the farms as civic ecologies.

Toolbox 1: Agents – The Setting

Oxford City Farm, founded in 2015, is one of the newest farms; Kentish Town is the oldest, dating back to 1972, and both are key case studies in this paper. Yet there are common characteristics motivating these and others; the repair of a fragmented socio-material landscape, where community assets have become the vehicle to provide coherence and continuity in the locality. The dynamics of these are provoked by the increasing commute to work, density of living conditions, access to green spaces, increasing support for mental health – concerns considerably exacerbated during the COVID-19 pandemic that took hold in 2020.¹⁷

The paucity of parkland and freedom to access public leisure spaces, problematised by a culture of private ownership, contribute to a desire for care through community engagement. Areas of high deprivation¹⁸ show the greatest density of city farms and community gardens, which happen to be in commercially unattractive locations. Formed forty years ago, SF& G has enjoyed huge growth in recent years, enabled by trusts and funding bodies such as 'City Bridge Fund', 'London Food Link' and 'Capital Growth'. Currently, SF & G manages and funds its own Community Land Advisory Service (CLAS)¹⁹ which enables communities to look for land, transfer green spaces from local authority to community management, and gain planning permission for nature based or green space projects.

There are nineteen city farms in London, sixty-five across the UK, and many more community gardens. In London these are found on sites affected by bomb damage, docklands waste, noise pollution and flooding. Kentish Town City Farm interweaves several railway tracks which serve north and west London. The land on which the farm is located is partly owned by London Underground²⁰ and Camden Council, the surrounding cultural demography of the area is mixed and the indices of deprivation high. Oxford City Farm, forms part of an attenuation flood plain and again there is a similar pattern to cultural demography and deprivation mapping levels.²¹

Typically, city farms are initiated by local groups in areas which are perceived as having little social cohesion. Where there is a need for social care, skills, and stewardship, such sites build a cohesive approach towards the environment, health, cultural resources, and planning. Both materially and ethically, farm sites re-activate and re-imagine their local settings to promote belonging and wellbeing. While the city farm's image may suggest a landscape of green produce, it is in fact a backdrop to a productive landscape of skills that encompass ethical, socio-political, and creative practices. Thus, the *Activities* formed by these settings play a dynamic role in the procurement of goods we may interpret as community assets and, in doing so, provide for the practices contributing to well-being. City farms can therefore be understood as socio-spatial initiatives that reflect or express a community's aspirations with regard to care of its setting. The documentation of the physical and

social landscape in Toolkit 01 as measured drawings, diagrams, photographs, and interviews has begun to establish the scene for the *Actors* and *Activities* to inhabit.

Toolbox 2: Actors – The Tales

"What individuals do" argues that the farm's practices work in partnership with the agency of the site to function as a diagnostic of the well-being in character with the setting. The study of *Actors* theoretically draws upon Bourdieu's field theory²² and "social, cultural and economic capital"²³ bringing their background to what individuals do on the farms to animate "care-in-common". Toolbox 02, documents the Tales of workers as a series of ethno-graphic Tales imagined as personal portraits, charting their individual journeys and involvement to depict and discuss how this contributes to the community and a sense of well-being for the farm.

During the 1960s and 70s, obtaining vacant property from Camden Council for community use was less commercially contested than it is today. The area of north Kentish Town and Gospel Oak was impoverished and initiatives to develop land for leisure and engage youths were considered a preferable alternative to urban decay. Working together, American-born Ed Berman, social worker and activist playwright, and architect Cedric Price, architect, initiated Inter-Action²⁴ on the site of the current Talacre Community Sports Centre.¹ Programmatically, Inter-Action echoed the ambitions of Price's Fun Palace²⁵ and, within a few years, spawned multiple projects around the area and was run by a co-operative of community workers and artists. Re-locating in 1972 along peripheral railway intersections, the community project further developed as the present Kentish Town City Farm, taking advantage of timber yard buildings in degrees of dereliction: sheds, stables, and Victorian warehouses. On Berman's initiative, the site provided an indoor riding school, threading learning initiatives through theatre practices.

One ethno-graphic story in Toolkit 02 is Jean's story. Her take begins in the 1960s and 70s when, as a volunteer at Gospel Oak Children's Workshop²⁶ in the Kiln Place Tenants Hall just north of the present farm, she and her partner involved children in the usual play activities as well as more imaginative ventures with film making for older children. Their aim was to empower children through experimentation in the form of "peripheral participation" and 'situated learning"²⁷ thereby establishing alternative routes for problem solving beyond the school curriculum.



Figure 2. Jean's ethno-graphic portrait - Image by author

Diane's story describes intuitive nurture, awareness and mutual respect between human and animals across the species barrier. Her quiet understanding of people, ability to nurture their confidence and build communication skills between vulnerable children and young adults, even though verbal communication might be absent, tells of her experience and knowledge of with the horses and empathy with people with special needs. She says the horses sense the mood; they "warm to calmness" and return it, lowering stress levels (particularly in autistic children or those with behavioural problems).

Simone's story (Figure. 3) highlights the farm's role in forming a social tapestry through theatre. Local to the area, she describes her role in the farm's social engagement with the community as "co-existing without much effort", whether at work, school, or play. Coming from a performance background, she "conducts the scene", compelling her *Actors* to engage while connecting and extending the farm as family into the neighbourhood.



Figure 3. Simone's ethno-graphic portrait - - Drawing by author

Whereas the provision of music facilities at Inter-Action appears by contrasted with horses and stables in its later iteration as the Kentish Town city farm, the core ambition continued as an engagement of the community through embedded learning, theatre practices and animal-human welfare. These values have forged the direction of the farm, noticeably drawing upon the socio-spatial attributes of its setting. It is not unusual to witness Simone and Claire's twice weekly donkey walking around the neighbourhood which brings people and traffic alike to pause momentarily. Nor is it unusual to watch a child with special needs become befriended by Shirly the cow or Jester the horse who patiently wait with a young adult to regain their balance.

Each of the Tales in Toolkit 02 fit, and actively engage with, the setting. Each of the authors have brought their background and skills as 'cultural capital'²⁸ to bear on the farm community. Each has been supported by the farm to develop their 'field', bring 'economic capital' to the *Activities* of the farm and speak of both personal and community well-being.

Toolbox 3: Activities - The Projects

Activities describe the farm initiatives characterised by the agency of the site, its field, and the capital of Actors. The remit of the Activities is repair through "task and gift" of the socio-material setting through an ethic of "care-in-common". Puig de la Bellacasa describes care as charged practice that

"joins together an affective state, a material vital doing, and an ethico-political obligation...;"²⁹ care for the land through time.³⁰ Similarly, Edensor frames care as the socio-material "entangled agencies of buildings,"³¹ their material weathering and socio-economic changes over time. Gibson³², Chemero, and Stoffregen³³ apply a similar approach of care to working with materials, where "affordance" is understood to be the agency,³⁴ engaging people and projects within the setting. Each description of care identifies a different scale, large to small and from economic to social, and all co-dependent in their stabilising of the dynamics of sustainability.

Toolbox 03 records interviews, educational podcasts, events, and live construction projects. However, whether these are individual pursuits or larger community engagements, they all contribute to the framework of well-being. Simple tasks such as mending fences or tending allotments, also engage the maker with networking and procurement of materials and the educational films on one level bring the cycle of life into schools on another reiterate the need to engage ethically with the setting. Lastly, the live projects invite a scaling-up as complex activities, such as surveying, drawing, consulting with the community, and procurement of the building, addressing, and contributing to the framework of wellbeing, "… a material vital doing, and an ethico-political obligation…"³⁵

Spheres of Action – The Stewardship

The motivational³⁶ and operational³⁷ frameworks together suggest that stabilising and sustaining a community through a co-dependency of care is a response to the concern for "repair" of our modern lifestyle. This, Cooper attests, ordinarily partitions our lives between a "public", "civic", or "professional" life and a more "private" life, where conduct is a matter of individual choice or "preference".³⁸

DISCUSSION

On a site, designated in 2015 at high risk of flooding by the Environmental Agency,³⁹ Oxford City Farm proposed the design and construction of several new buildings, including offices, toilets, catering facilities, storage and barns for the animals. This provided a complex project to explore, whether the farm could usefully steward the all four *Spheres of Action*, with the community, and from there assess the value it brought the farm in terms of "care-in-common".

The tasks have been separated into the four *Actions*: the first, "mending", researched the landscape, its locality, geology, and topography in relation to flooding. The second, "making", discussed materiality and social purpose, specifically exploring possibilities of species of tree on the site to fell for timber. The third, "networking", opened the project to local craft, expertise and manufactures. And the fourth, "governing", brought the project into contact with aspects of procurement including local community and engineers, involving farmers and neighbours as well as statutory and legal bodies in policy action. A set of final drawings were detailed to be delivered to site as a flat pack with instructions so that the community labour needed little prior knowledge of carpentry and the assembly method and timescales times accommodated weekend fabrication. The style of communication was borrowed from the IKEA assembly manuals and designed to engage its makers in familiar working methods.⁴⁰ Thus communication, involvement and ease of delivery became a primary concern and importantly an strategy to empower its members (Figure 4).



Figure 4. assembly drawings - Drawing by author

Many consultations were undertaken with the local community including neighbours and adjacent institutions. The promise and care of communication through drawings and models with the public eventually served to secure planning permission and months spent with the engineer finally achieved approval for building regulations, producing a scheme which could be fabricated on site with few skills. However, the construction was deemed marginally over budget and compounded by the insurance commitments meant the efforts to involve the community in the process of fabrication were unfulfilled. In place the trustees ordered a couple of gazebos from B&Q and a local builder assembled on site.⁴¹

CONCLUSION

Finances are always one of the most pressing issues for city farms and it is difficult to calculate the value a community build might bring, particularly, as the gazebos facilitated a new outdoor kitchen without much fuss. Fuss however also goes hand in hand with an attention to care. It would have included the sourcing of sustainable timber and choreographing the project through several weekends with the hands-on final stages of its erection. It would also have been a vehicle to consider the existing conifers on site for construction as these had been tested for suitability. And an opportunity to teach carpentry and skills, as well as introduce the community to methods of assembly which were designed to be up-scaled for other constructions on the farm.

This thesis here presented frames "community" in relation to the temporality of the setting, it points towards a holistic caring-for, which frames the *Spheres of Action* in this context of well-being. Ethical *Activities*, further 'care' through each of their *Spheres of Action*; mending, making, networking, and governing, which in turn allows scaling-up, through progressively complex *Activities* proposed by the farm. It was earlier argued that city farms are "unstable" microcosms. The benevolent *Action* of "mending" therefore may only act to momentarily stabilise their future. If communities reflect their setting, in this context, it follows that firstly, communities are dynamic, and secondly, they must be ready to re-repair, as their setting changes over time, their observations of this change being always attentive to engaging the *Actors* at all *Spheres of Action*.

NOTES

¹ "English Indices of Deprivation 2019." GOV.UK, accessed January 5, 2022, https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019.

² "Federation of City Farms & Community Gardens," accessed January 5, 2022, https://naee.org.uk/the-federation-of-city-farms-and-community-gardens/.

³ Steven J. Jackson, "Rethinking Repair." Media Technologies: Essays on Communication, Materiality, and Society (The MIT Press, 2014), 221–40.

⁴ Maria Puig de la Bellacasa, "Matters of Care in Technoscience: Assembling Neglected Things," Social Studies of Science 41, no.1 (2011): 85–106.

⁵ Robert Esposito and Vanessa Lemm, and Timothy Campbell. "Introduction: Biopolitics and Community," in *In Terms of the Political: Community, Immunity, Biopolitics*. Fordham (University Press, 2012. Fordham Scholarship Online, 2013). 14–26 http://www.jstor.org/stable/j.ctt13x0bdm.4.

⁶ Marianne E. Krasny and Keith G. Tidball, "Applying a resilience systems framework to urban environmental education," Environmental Education Research, Environmental Education Research, 15, no. 4 (2009): 465–82, https://doi.org/doi.org/10.1080/13504620903003290.

⁷ Activities, are conducted as a result of the farm *Projects* initiated by the farm to engage the local community.

⁸ Marianne E. Krasny and Keith G. Tidball, "Broken Places," in *Civic Ecology: Adaptation and Transformation from the Ground Up*, 2015, https://doi.org/10.7551/mitpress/9952.003.0006.

⁹ Robert Esposito, Vanessa Lemm, and Timothy Campbell, "Introduction: Biopolitics and Community," in *In Terms of the Political: Community, Immunity, Biopolitics* (Fordham University Press, 2012. Fordham Scholarship Online, 2013), 14–26, http://www.jstor.org/stable/j.ctt13x0bdm.4.

¹⁰ Spheres of Action: the authors term used to describe four actions: mending, making, networking, and governing, requiring increasingly complex spheres of involvement.

¹¹ Abraham H. Maslow, *Theory of Human Motivation* ([S.I.]: WWW.bnpublishing.com, 2020).

¹² Marianne E. Krasny and Keith G. Tidball, 'Applying a resilience systems framework to urban environmental education', Environmental Education Research, Environmental Education Research, 15, no. 4 (2009): 465–82, https://doi.org/doi.org/10.1080/13504620903003290.

¹³ Robert Esposito, Vanessa Lemm, and Timothy Campbell, "Introduction: Biopolitics and Community," in *In Terms of the Political: Community, Immunity, Biopolitics* (Fordham University Press, 2012. Fordham Scholarship Online, 2013), http://www.jstor.org/stable/j.ctt13x0bdm.4.14–26,

¹⁴ Agents: the authors term used to describe the socio-material agency of the setting

¹⁵ Actors: the authors term used to describe the farm workers

¹⁶ *Projects* include events and activities initiated by the farm to engage the local community. The research focusses on live construction projects and film making for the public.

¹⁷ James Banks, Daisy Fancourt, and Xiaowei Xu, "Mental Health and the COVID-19 Pandemic," Report, Institute of Fiscal Studies, accessed 5 January 2022, https://ifs.org.uk/publications/15368.

¹⁸ "English Indices of Deprivation 2019," GOV.UK, accessed January 5 2022

https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019.

¹⁹ "The Community Land Advisory Service," Social Farms & Gardens, accessed 5 January 2022, https://www.farmgarden.org.uk/clas.

²⁰ "Gospel Oak Rail Station," Transport for London, accessed 5 January 2022,

https://tfl.gov.uk/hub/stop/910GGOSPLOK/gospel-oak-rail-station/.

²¹ "English Indices of Deprivation 2019," GOV.UK, accessed January 5 2022

https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019.

²² Pierre Bourdieu and Randal Johnson, *The Field of Cultural Production: Essays on Art and Literature* (Cambridge: Polity Press in association with Blackwell, 1993).

²³ Pierre Bourdieu and Richard. Nice, *Distinction: A Social Critique of the Judgement of Taste* (Harvard: Harvard University Press, 1984).

²⁴ "Inter-Action", Unfinished Histories, accessed 5 January 2022,

https://www.unfinishedhistories.com/history/companies/inter-action/.

²⁵ Stanley Mathews, "The Fun Palace as Virtual Architecture: Cedric Price and the Practices of Indeterminacy," *Journal of Architectural Education (1984-)* 59, no. 3 (2006): 39–48.

²⁶ A play scheme for the 3–5-year-olds in 'Kiln Place Tenants Hall'. The play scheme was to replace a youth club which has fallen into disrepute.

²⁷ Jean Lave and Etienne Wenger-Trayner, *Situated Learning: Legitimate Peripheral Participation* (Cambridge: Cambridge University Press, 1996).

²⁸ Pierre Bourdieu and Richard Nice, *Distinction: A Social Critique of the Judgement of Taste* (Harvard: Harvard University Press, 1984).

²⁹ Maria Puig de la Bellacasa, "Making time for soil: Technoscientific futurity and the pace of care," Social Studies of Science 45, no. 5 (2015): 691–716. https://doi.org/10.1177/0306312715599851.

³⁰ Puig de la Bellacasa, 681-716

³¹ Tim Edensor, "Entangled Agencies, Material Networks and Repair in a Building Assemblage: The Mutable Stone of St Ann's Church, Manchester," in *Transactions of the Institute of British Geographers* 36 (2011): 238–52, https://doi.org/10.1111/J.1475-5661.2010.00421.X.

³² James G. Gibson, "The Theory of Affordance," in *The Ecological Approach to Visual Perception* (Hillsdale, N.J: Psychology Press Classic Additions, 2015), 119–36.

³³ Anthony Chemero, "An Outline of a Theory of Affordances," Ecological Psychology 15, no. 2 (2003): 181–95, https://doi.org/doi.org/10.1207/S15326969ECO1502_5.

³⁴ Andrew Pickering, "The Mangle of Practice: Time, Agency, and Science," Technology and Culture 3899, no. 3 (1996): 559–89, https://doi.org/10.2307/3106908.

³⁵ Maria Puig de la Bellacasa, "Matters of Care in Technoscience: Assembling Neglected Things," Social Studies of Science 41, no. No.1 (February 2011): 85–106, https://doi.org/10.1177/0306312710380301.

³⁶ Abraham H. Maslow, Theory of Human Motivation ([S.I.]: WWW.bnpublishing.com, 2020).

³⁷ Marianne E Krasny and Keith G Tidball, "Civic Ecology: A Pathway for Earth Stewardship in Cities," Frontiers in Ecology and the Environment 10, no. 5 (2012): 267–73, https://doi.org/doi.org/10.1890/110230.

³⁸ David E. Cooper, "The Good Life", in *A Philosophy of Gardens* (New York: Oxford University Press, 2006), 99– 107.

³⁹ "Environmental Agency," GOV.UK, accessed 5 January 2022, https://check-for-flooding.service.gov.uk/riverand-sea-levels?q=Oxford.

⁴⁰ "Assembly Instructions," IKEA, accessed 5 January 2022, https://www.ikea.com/gb/en/customer-service/product-support/assembly-guides/.

⁴¹ "Outdoor & Garden," B&Q, accessed 5 January 2022, https://www.diy.com/departments/outdoor-garden/DIY780276.cat.

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AN INVESTIGATION INTO THE VALUE OF DESIGN IN NATURE-BASED SOLUTIONS FOR HEALTH AND WELLBEING IN A POST-COVID WORLD

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INTRODUCTION

The COVID-19 pandemic has precipitated a widespread deterioration of health and wellbeing. 1.41 million people in the UK were in contact with mental health services at the end of March 2021 and some places have seen referrals more than double compared to pre-COVID levels.¹ The connection between obesity and COVID-19 has also been recognised during this pandemic, not just as an emerging risk factor for the disease but also as a long-term public health emergency.² This imperative has instigated a greater focus on health and wellbeing, nationally and by local authorities. The search for non-clinical interventions to address COVID-19 related public health issues has become a top priority for many governments. The turn to non-clinical approaches for health and wellbeing is a major shift in public health thinking.³

Within the specific context of pandemic induced lockdowns, local green spaces took on new significance in many people's lives. There is ample evidence of wellbeing pathways from nature, and growing interest in supporting non-clinical interventions, such as community gardening and food-growing projects, for mental wellbeing and public health. Such activities have been clinically recognised as valid options to increase exercise, improve mental health and reduce obesity.⁴ As a result, Nature-based Solutions (NbS) were rediscovered and widely promoted. NbS are "actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits".⁵ In 2020, Public Health England highlighted the importance of local green (and blue) spaces as critical assets for maintaining and supporting health and wellbeing in local communities.⁶

Acting upon these challenges, and to innovate NbS for health and wellbeing, calls for collaboration across disciplines that goes beyond public health research to include disciplines such as environmental science, landscape architecture, and the social sciences. It also calls for collaboration beyond academic disciplines to include various stakeholders in the system, such as communities, local governments, and businesses.

THE STATE OF THE ART Nature-based Solutions (NbS)

A growing body of epidemiological and other evidence indicates that greater exposure to, or contact with, natural environments contributes to better health and wellbeing.⁷ In particular, connectedness with nature is associated with a sense of gratitude and self-worth that can help people recover from stress and mental illness, and build a sense of place and community and foster feelings of belonging.⁸ There is an increasing interest in NbS research and practice permeated by the notion of Transdisciplinarity:⁹ the science of "complex problems" par excellence. The sustainability sciences have been particularly receptive to relevant methods of "co-production" of scientifically grounded and, at the same time, transformative knowledge.¹⁰ Innovating NbS for health and wellbeing particularly is a case that goes beyond this subject to engage wider knowledge in other disciplines, and in communities and third sector organisations.

Transdisciplinarity

Transdisciplinarity is viewed as a practice of bringing together knowledge from the physical and social sciences and from practitioners, users and the broader community, to confront increasingly complex problems.¹¹ It is positioned as essential to understanding problems and finding solutions for global challenges by enabling a holistic view, integrating diverse knowledge and transcending disciplinary approaches.¹² There is consensus that transdisciplinary approaches involve moving beyond and integrating individual disciplines, thereby enabling development and application of new research strategies and knowledge.¹³

The importance of transdisciplinarity has been discussed from different perspectives. For example, in social–ecological analyses of human–environment systems environmental studies emphasise a transdisciplinary action research orientation in which diverse knowledge cultures or epistemologies (e.g. academic-disciplinary, professional-practitioner, lay citizen perspectives) are brought together for purposes of better understanding and ultimately improving the resilience and sustainability of people–environment systems.¹⁴ In health, it is recognised that rapid urbanisation, widening inequalities, climate change and the rising burden of chronic disease are all complex societal problems that affect health, but will not be solved by health researchers or practitioners working alone. Transdisciplinary approaches are seen as valuable to address today's complex health problems and widening inequalities.¹⁵

A growing body of literature residing at the intersection of research methodology and health, sustainability and NbS studies, promotes transdisciplinarity. However, the practice of implementing the transdisciplinary approach in multidisciplinary and multi-stakeholder projects is still to be further explored and its value to be evidenced.

Design

In the contemporary context, designers often find themselves called into projects to tackle major challenges, such as healthcare and wellbeing, sustainability, and digital transformation. These challenges are complex and interdependent, requiring collaborative innovation between different disciplines, between experts and users, and between researchers and practitioners. Dorst sees that the value of design in this kind of transdisciplinarity lies in its ability to deeply consider innovation-between-fields, leading to the adoption of principles and practices that are completely new to the problem situation.¹⁶ Design, therefore, holds great potential to foster a collaborative culture and practice.

Traditionally, design is associated with making visual artefacts and industrial production. Landscape architecture, as the design field seemingly most closely linked to NbS, tends to focus on physical rather than programmatic changes to a given site. Whilst traditionally landscape architecture takes account of a wide, complex and inter-related set of factors - including social issues - in arriving at a solution, the disciplinary focus lies with shaping the materials of landscape rather than less tangible social interactions and structures. Notwithstanding, design has shifted from the legacy in producing tangible objects towards tackling social, environmental, cultural, and business challenges. This transition has long been recognised in Krippendorff's "The semantic turn: A new foundation for design", where it was suggested that design had shifted gears from a preoccupation with the appearance and surfaces of tangible products to designing material and social artefacts that have a chance to make sense to their users, aid larger communities, and support a society that is reconstructing itself in unprecedented ways and at record speed.¹⁷ Many designers have pushed the boundaries of design into new territories e.g. service, system, strategy, policy, business model, and sustainability. These have become the frontiers of design that have expanded the meaning and practice of design to be an integral part of transdisciplinary innovation.

There is ample design literature rationalising and justifying the transdisciplinary nature of design, which is underpinned by the reality that design has no special subject matter of its own apart from what a designer conceives it to be, whilst the design problems are "indeterminate" and "wicked".¹⁸ Designers use a "designerly way of knowledge" to generate understanding of the design problem.¹⁹ This "designerly" paradigm of knowledge generation is guided through design process logic supported by phases of scientific research and inquiry.²⁰ In this process, Dorst considers that the design process provides designers with a thoughtful way to re-interpret and rethink existing problem situations, and to identify practices from various fields and disciplines that could be built on.²¹ From this deep rethinking, designers can access the broadest possible collection of principles, methods, and actions, while considering how these principles, methods, and actions may assist the designers. This type of deeply considered innovation-between-fields leads to the adoption of principles and practices that are completely new to the problem situation.

METHODS

In this context, Nature's Way, an AHRC (Art and Humanities Research Council) funded research project, was initiated to explore how design can be used in the collaborative search for solutions for a more nature-based approach to health, wellbeing and social care. It aims to co-create the ways of accessing and sharing otherwise disconnected or not-readily-available knowledge, resources, and best practice of innovating nature-based activities. The ultimate goal is to empower communities, organisations, and individuals to innovate, develop projects that involve engagement with nature to deliver health benefits following COVID-19. One of the project foci is Walsall (a pilot site for this project), one of the top 20% most deprived areas in England, with five years lower healthy life expectancy compared with the national average and the average for the West Midlands as a whole.²²

The central methodology of this project is Research through Design (RtD).²³ It represents an openended, transdisciplinary search for new, creative and actionable solutions for complex challenges. This stage of work aims to (i) build a holistic understanding of the local social contexts and systems around NbS in Walsall; and (ii) reframe the challenges and identify opportunities for innovation.

The design team has worked closely together with researchers in service design, landscape architecture and social science. The team has conducted intensive research and has engaged a wider range of local Voluntary, Community & Social Enterprise (VCSE) organisations (including seven

community gardens and allotments, two pocket gardens, four public parks, three nature-based activity schemes), social housing groups, the NHS clinical commissioning team and the Healthy Spaces team within Walsall Council. The design team has also delivered over 10 co-creation workshops with researchers, practitioners and experts including those in green care and health, land management, and policy to review and define findings from the user research.

The designers have used a mix of design research tools including system mapping, user journey mapping, interviews, observations and workshops. At the end of this phase, a large volume of data has been collected that generated in-depth insights into the system and the experience of individuals operating in the space of NbS. Through the interactive workshops, the project is able to reframe the challenges and to identify opportunities for design interventions.

Based on data from analysing designers' weekly reflective journals (over a period of six months), documents produced by the designers (e.g. meeting notes, visual presentations through the digital platform, Miro, and blogs), this paper builds a case study that critically analyses the role and potential of design in transdisciplinary research projects of this kind.

FINDINGS AND DISCUSSION

Design and Collaboration

In the context of NbS, the learning from the project suggests that innovating NbS for health and wellbeing is a challenge that requires a transdisciplinary approach, which engages different parts of the system and beyond in a collaborative fashion. Our findings indicate that it is challenging for the existing system to respond to these needs. The project finds that the current health and social care system is a complex of entrenched practices patched with new interventions, such as social prescribing. Likewise, the approach to commissioning and managing urban green spaces varies widely within and between different local authorities.

In Walsall, three social prescribing pathways have been developed respectively by primary care, Walsall Housing Group (whg), and the Healthy Spaces Team at Walsall Council. The pathways have differing foci and have developed their own networks of VCSEs and ways of working. This creates a challenge for VCSEs in navigating through the system. The systemic challenge is not owned by one single party or driven by one single issue, but by a complex mix of environmental and social factors which play out in a local area or place. In particular, we have found that communication and coordination between NbS providers and the other organisations that make up the system is lacking. There needs to be a co-operative mechanism that works across all the organisations involved to support better collaboration. A holistic approach is needed to navigate this complexity and to interpret the specific structure and needs of communities within the area and beyond.

As part of the project, the team has gone through an iterative process of mapping the systems to identify and engage key stakeholders. By working collaboratively with people who live and work locally, the project has visualised the system from a local perspective, taking an asset-based approach that highlights the strengths, capacity and knowledge of all involved (see Figure 1). In doing so, different perspectives and voices have been revealed. Through engagement in developing the system maps, people have joined open dialogues that enable more diverse insights to be generated and the voices of different stakeholders to be heard. Through co-creation workshops, these different viewpoints have been shared, enabling people to see things from different perspectives, creating empathy with each other. The core of the practice is to generate empathy between stakeholders, acknowledging that they are experts in their own lived experience. This creates a solid foundation for breaking siloed ways of working, fostering a more collaborative culture and practice.



Figure 1. An Example of Visual Presentation of Local NbS System Map.

Design and Place-Based Thinking

The learning from the project also suggests the importance of a genuinely bottom-up and place-based approach to considering the totality of local assets, including the realities of the physical locality and local lived experience. Place-based thinking has a long intellectual history, and its importance has been widely recognised in regional development and public health practice.²⁴ In NbS, the richness of local knowledge held by grassroots organisations is usually under-valued, and could be used far more effectively to connect people with their local natural environments. These local VCSEs are instrumental in delivering the benefits of NbS, but they are not effectively integrated in the wider health care system. At the same time, they require support throughout the whole process of funding, initiating, developing and sustaining NbS, and this is often lacking.

In Nature's Way, user journey mapping has been used as a way to engage NbS providers in open dialogues to understand their experience, needs and strengths (see Figure 2). The human-centred ethos of design is conceptually mirrored in the place-based thinking. Based on the insights generated from the mapping exercises, the team then engaged these individuals and knowledge experts in workshops to co-create possible ways to support VCSEs. As such, the most important issues and opportunities in the communities are identified, which enables focusing the efforts collaboratively and initiating changes from bottom-up. The visual representation of individual experience (user journey maps) brings together locally-embedded knowledge and expert knowledge for meaningful collaboration.



Figure 2: An Example of a Section from a User Journey Map

Design's strengths

Numerous design strengths are being foregrounded through the research process. Firstly, design entails both divergent and convergent thinking, steered in an iterative manner by evolving evidence, rather than rigidly sticking to ideas formed at the project's commencement. Designers are more like facilitators, providing space and tools for people to share their experiences, and taking the "passenger seat" rather than dictating anything. The design team values genuine co-creation to realise the humancentred ethos of design, and true partnership requires flexibility. Designers are well-placed to cope with uncertainty; the outcome from any project is not guaranteed until its conclusion. Designers are primed to be flexible and responsive, and to work in an iterative and user-centric way, with the project's parameters shifting as the users' needs and wishes crystalise through methods of co-creation. Design is also well-suited to communicate large, systemic ideas, or complex information, in accessible and engaging ways. The discipline is adept at breaking down problems to find their root causes, including through seeing things from alternative viewpoints - at reframing problems to better understand their nature, and how and where to intervene. This can be productively linked to empathy through understanding and conveying someone else's experiences. Designers can be seen as translators: understanding complexity and knowledge provided by communities and translating this into visions to enable action.

CONCLUSION

The learning from Nature's Way has confirmed the value and validity of the design approach in generating new and transformative knowledge, facilitating collaboration in a multidisciplinary and multi-stakeholder project, and fostering an innovation culture and practice from the bottom up, greatly needed from the perspectives of public health research,²⁵ Nature-based Solutions research,²⁶ and social innovation and community development.²⁷

The paper considers the transdisciplinarity of design practice, and the value this brings. It sees design as a way to facilitate transdisciplinary innovation of NbS. The project explores the opportunities design can create in the space of community-led NbS for health and wellbeing.

• Design practice enables collaboration that empowers communities and stimulates the formation of long-term relationships. In the project, the most valuable outcomes are not the 'solutions' aimed

for, but the process which is based on strong commitment, openness, a humble attitude, and willingness to take risks. This way of working opens up opportunities for genuine collaboration.

- Design practice creates the possibility for transmitting rich narratives and impactful stories of personal experience complementary to evidence-based reporting. The voices of the VCSEs organisations we work with are rarely heard. The design tools create an effective way to foreground their voices through a range of design outputs, e.g., visual representations of their experience.
- Design practice offers support to visualise complex systems and existing assets or activities as a baseline to identify opportunities for new NbS. This allows the start of a systemic approach towards better understanding of the complexity of the system in which NbS are involved.

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PUBLIC TRANSPORT, NEW SUSTAINABILITY CHALLENGE IN OMAN, CASE STUDY-MUSCAT

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INTRODUCTION

Oman started its modern era in 1970 with an extensive program of infrastructure and urban development funded by a progressively rising oil revenue. The capital Muscat experienced urban sprawl growth and the associated accessibility issues made private cars the dominant form of transport. This lifestyle led to many health and social issues, as well as sustainability challenges like high energy consumption, carbon emissions, and air pollution.

In recent years, public transit was seen as a key factor in mitigating those issues. In 2014 the stateowned public transport company, Oman National Transport Company (ONTC) was tasked with upgrading Muscat's public transport services. Despite the significant progress ONTC has made, many challenges remain given that only 1.6% of the city's population regularly use the city's brand-new bus service.

This research aims at providing a development scheme to support public transport to become the main sustainable form of travel in Muscat; proposing some key features to increase accessibility, walkability, urban quality, and sustainable transit modes to enhance public health, minimize environmental footprint, and reap its social benefits.

OVERVIEW OF OMAN DURING THE LAST CENTURY

In 1970, Sultan Qaboos started his 50-year reign, Oman at the time was a listless and closed country.¹ The new Sultan started a comprehensive program of urban development and infrastructural renovation of which Muscat, the capital, was given a priority.² Massive progress was made during the first 40 years that in 2010, Oman had the largest Human Development Index in the world according to the United Nations Human Development Report.³ The recent provision of Public Transport Service in Oman in 2014 was part of that overall strategy.

PUBLIC TRANSPORT FROM THE SUSTAINABILITY AND HEALTH ASPECTS

Tracing the relationship between city development and public transport will shed light on the paper's issue and suggested approaches.

Shifting to Sprawl Urban-Beginning and Reasons

British economist Colin Clark investigated city development worldwide and found that until the 1800s cities spread within a radius of around 5 kilometers from their center as to make the residents' daily commute to work within walking distance. Then by the end of the 19th century, some cities around the

world had some form of cheap and effective public transit system, horse tram, bus, electric tram, steam trains, etc. Consequently, the radius a city grew tremendously to 24 kilometers from the center. Moreover, motor buses and electric trams induced suburban sprawl up to five times the previous limit. Those changes affected the accessibility pattern within the urban zone. Cities continued to grow outwards despite the fact that most work opportunities, services and shops remined in the city center. Thus, traffic congestion in urban areas was increasing, and the average daily commute was becoming longer. It was argued that this situation imposed an unreasonable burden on the residents.⁴

Adopting sprawl type consequences

Recent studies investigated the impact of this transition from walkable cities to urban sprawl cities on human wellbeing. It was found that the biggest changes were the decrease in both sustainability and public health.

Sustainability and city spread type

In 1987 with the release of "Our Common Future" report prepared by the Brundt Land Commission; people started to realize that human activities have a tremendous influence on the environment. Sustainability was identified as "meeting the needs of the present without compromising the ability of future generations to meet their own needs".⁵ Among the ten goals of sustainability, the three ones linked directly to a sustainable city planning are environmental sustainability, economic sustainability, and social sustainability.⁶

At the environmental level, one of the major current challenges for worldwide cities is upgrading the quality of life for people via minimizing pollution and addressing climate change. Some researchers concluded that transportation is the main contributor to CO_2 emissions in cities. The current prevailing model of sprawled cities has negatively affected accessibility which resulted in the overuse of cars. However, urban planners have a strong preference for public transport due to its large capacity, smaller area requirements, lower fuel consumption and lower cost.

Achieving economic sustainability with transportation hinges on maximizing the effectiveness of the resources used. Therefore, the aim should be to get residents to their destination using the least amount of resources possible; energy consumption, machine wear, and infrastructure should all be taken into account. In those areas, public transport beats private cars handily on a per passenger basis, making it our preferred approach for achieving economic sustainability.⁷ On the other hand, Dr. Chinmoy Sarkar demanded that governments create more walkable and activity friendly environments in cities to improve public health; currently some of our biggest public health challenges like cardiovascular disease are directly linked to our current mostly sedentary lifestyle.⁸

Regarding the social sustainability, the psychologists emphasized the benefits of social contact and travel for human beings. In addition, Nelson Curl et al wrote that city accessibility planning is relevant to social inclusion/exclusion and quality of life. Moreover, social justice issues like providing equal opportunity for people to access their families, city services and other facilities has to be taken into consideration. Furthermore, a study examined the link between the social and physical environments of a variety of neighborhoods in Japan revealed that the frequency of conversations and greetings with neighbors is highly correlated with the use of public transport over cars.⁹

Health benefits of public transit

The Institute of Transportation and development Policy published a report which recognized that changing cities to be more walkable is essential to achieving better public health. The report concluded that the current low walkability is related to the dominant type of urban sprawl.¹⁰ Many studies have identified the sedentary lifestyle as a major threat to public health. The effects range from hypertension, obesity, and respiratory concerns to mental health issues. The reasons are varied but

include traffic noise, decreased air quality and decreased physical activity.¹¹ In addition, a research published in the International Journal of Hygiene and Environmental Health revealed that hypertension was the biggest risk factor for cardiovascular diseases and other chronic ailments. The research argued for the necessity of a public health intervention in urban planning and design. Recently, the World Health Organization issued guidelines for a minimum level of physical activity to maintain a healthy and active lifestyle.¹² Subsequently, a number of studies revealed that public transit users spend more time walking than average and enjoyed a higher level of physical activity. In addition, another research emphasized that convenient access to transit stations is a key determiner of public transport use.¹³

PUBLIC TRANSPORT CHALLENGES IN MUSCAT

Oman has a large surface area of 309,500 square kilometers¹⁴ with a low population density of 6 residents per km².¹⁵ In contrast, neighboring United Arab Emirates is 98,648 km^{2 16} with 139 residents per km².¹⁷ The large oil reserves discovered in 1970 combined with the land availability enabled the state to build mostly low-rise style buildings. According to Muscat Municipality, the residential house height was restricted to three floors and apartment buildings can be up to ten floors.¹⁸ Consequently, urban sprawl dominated the city and private cars were used by nearly all residents. To make things worse, the city lacked any form of public transport before 2014.¹⁹ Experts agree that public transit systems are much less effective when the population density is low.²⁰

Recent public transport availability in Oman

The current decline in oil prices during the last couple of years made the state rethink some of its policies and adopt new approaches.²¹ The increase of Muscat's population -from 120,000 in 1980 to 1,062,000 in 2014-²² added to growing traffic congestion, air and sound pollution, and CO_2 emissions. Oman has yet to fulfill its international commitments to reduce its carbon emissions as per the Paris Agreement.²³

Accordingly, ONTC was asked in 2014 to start providing public transit services in Muscat and two other major cities, Sohar and Salalah. The company re-branded itself as MWASLAT in 2015 with a mission to be a world-class transit operator (Interview with Eng. Mohammed Al Ghafri, Acting Chair Operation Office, MWASLAT, conducted by the author on June 15, 2021). Later in 2015, in order to maintain international service standards, MWASLAT entered an agreement with Grupo Ruiz, a Spanish operator, to help devise a strategy for providing integrated and efficient bus services.²⁴ Eng. Al Ghafri also outlined how much their services have grown, which is summed up in Figure 1. MWASLAT has also won many awards globally and regionally like the IRU Bus Excellence Award-AC Mercedes buses and coaches- 2017.

Evaluation of Public Transport Service in Muscat-Case Study

Despite the aforementioned achievements, the public transit services were used by only 1.5% of Muscat's residents according to Eng. Al Ghafri. Due to the lack of public data records on public transport use in Oman, the above interview was conducted and a survey was given to the students of the Scientific College of Design and their family members to represent a sample of Muscat's population.



Figure 1. The development of Oman National Transport Company services (Source: Eng. Mohammed Al Ghafri, MWASLAT)

In order to ensure the sample was truly representative of the population, it included several age groups, both genders, different professions, and different neighborhoods spread throughout Muscat. The total number of forms distributed was one hundred and eighty, and the responses received were seventy-two, with a rate of 56.25%. The data shows that the participants live in fifteen different neighborhoods, females were 54% of the sample, the mean age group was 18-30 with a ratio of 63%, car owners represented 68% of the participants, and when combined with the number of people who carpool the number becomes 79.2%, which underlines the high rate of private car use. To the best of the author's knowledge, this is the first survey of its kind in the country to assess the attitude towards public transport and the effectiveness of the supporting measures proposed in this paper. It is worth mentioning that MWASLAT conducts annual surveys to measure user satisfaction. The challenges could be summarized as follows:

Public Transport Accessibility

Accessibility has many definitions; the one relevant to public transport was defined by Dunn Joycee as "The quality of transportation supporting specific area and the easiness with which residents can access the service". Some researchers divide accessibility into three categories; access to destinations via public transit, journey time, and distance from a home to the nearest transit station.²⁵ The current distribution of transit stops in Muscat as shown in Figure 2 give neither efficient access to destinations nor effective access to transit stops except for a limited population that lives close to the bus city routes and one kilometer away from the bus stops, which is considered an easily walkable distance.²⁶ From a time perspective, a convenient walkable distance should take no longer than ten minutes.²⁷ Figure 2 shows that only 28% of the survey participants live within that convenient walkable distance to the nearest bus stop.

When it comes to journey duration, Figure 3 shows the time each participant takes to commute with a car compared to the time it would take them to reach the nearest bus stop. In some cases, it takes less time to commute with a car than to walk to the nearest bus stop.

Some scholars noted that most governments have not yet appreciated the link between transport journey time and economic vibrancy and development.²⁸ According to Eng. Mohamed, the current linear type of bus routes is not efficient. Ideally, they should be branching like the backbone of a fish.
Furthermore, the 75% participants who do not use public transit indicated their reasons in Figure 4. The three biggest factors of more time taken than the private car, bus stops being too far from home and too far from work, are all related to accessibility.



Figure 2. only 28% of the survey participants live in the convenient walking zone, highlighted in yellow, around the Public Transport routs in Muscat (Map by MWASLAT).



Figure 3. A comparison between time to commute and to walk to the nearest bus.



Figure 4. The reasons indicated by 75% Of the participants for being non-public transport users.

Public Transport Competitive Properties

Private car usage has always been seen as better than public transit, not only for its convenience, comfort, and freedom, but also for the driving pleasure and the status symbol cars represent in society.²⁹ In addition, the door-to-door accessibility of the private car poses a formidable challenge to

public transit.³⁰ The survey showed that 91.70% use private cars to commute. In addition, the car is also used for many different activities as shown in Figure 5. The high rate of using private cars for daily life essentials (groceries 71%, and pharmacy 57%) indicates the need to revise the neighborhood land use to improve public transport accessibility to those services. In addition, when the participants were asked if they would ever use public transport, 75% of the participants declined. Accordingly, it seems that more supportive facilities must be incorporated within the city's public transit system on top of the current excellent features MWASALAT offers.



Figure 5. Non-public transportation ratio of the survey sample and car use rate to a variety of destinations/services.

Climate Challenge

Muscat has harsh hot desert climate; summers last from April to December, with average daytime highs of 48 °C and lows of 32 °C, combined with high levels of humidity year-round.³¹ The survey responses about what factors would encourage the use public transport centered around mitigating the harsh climate as shown in Figure 6; equipping the bus stops with AC was 64%, then providing electric vehicles to move the users from the bus stop to their homes (adding door-to door convenience).



Figure 6. Factors that would encourage survey patricians to use more public transport

Public Transport Promotion

MWASALAT was awarded a global award for merit in strategic planning by the International Road Transport Federation 2019, according to Eng. Al Ghafri. However, it seems that it needs to promote

its facilities and services for the people as well. Despite already having designated spaces for females in the buses and coaches, 46% of the survey respondents who don't use public transport said they will use it if this feature was added. (See Figure 4) In addition, 35% of the respondents believe that the bus is not comfortable.

Walking Attractiveness

As was mentioned before, many scholars established a link between using public transit and walking. Accordingly, they urged city planners and authorities to support walking infrastructure.³² Designing pedestrian-friendly walkways includes continuous wide sidewalks, crossing facilities, aesthetic features (tree-lined streets), garbage bins, interesting views, and architecture.³³ Guan emphasized providing shade for pedestrians, which is especially important in Muscat given its climate, and would help in providing a comfortable and convenient walking experience.³⁴ The survey participants approved providing a shaded pedestrian walkway flanked by trees, flowers and plants from the bus stop to destinations by almost 40% (See Figure 6).

PRIMARY PROPOSAL FOR ACCESSIBLE, EFFICIENT AND SUSTAINABLE PUBLIC TRANSPORT.

Based on the data gathered from the literature, survey results, analysis and interview with a high-ranking employee in MWASALAT, this research will provide some guidelines to support encouraging people in Muscat – and other cities in the Sultanate- to regularly use public transport.

Neighborhood Urban Design and Public Transit Network

As Urban design is the key factor in achieving sustainable and healthy cities,³⁵ this research proposes dividing existing districts into compact neighborhoods with a 5–10-minute walking distance from their houses to livable centers with mixed-use buildings that fulfill the daily needs of people. Consequently, the neighborhood will be more pedestrian oriented, adding opportunities for walking and encouraging the use of public transport. Then, these centers could be connected via public electric vehicles to a neighborhood center that is connected the bus city route via a new extension, Accordingly, the current linear type of city bus route will become the efficient fish backbone type that is more accessible, sustainable, and healthier. The above proposal was applied to the Madinat Al Sultan Qaboos District in Muscat; It was divided into four compact neighborhoods; N1-N4 with livable centers; C1-C4. In this example, the maximum walking distance for any resident to get to their nearest transit station will be 1.20 km, which is considered a convenient walking distance.



Figure 7. Madinat Al Sultan Qaboos – Example of applying the suggested proposal to add accessibility to the public transportation in Muscat – Existing city bus route – New suggested extension C: Neighborhood/Distract center: – – Electric car path F: 5-10m walking distance (Prepared by the author – Map from Muscat Municipality)

Pedestrian Backing Infrastructure

Creating a "walk appeal" via providing an enjoyable environment that will help with the ease of access to shaded walkways with arcades and stairways introduce an interesting walking experience³⁶ and mitigate the harsh climate conditions. In addition, providing the essential physical elements of walking infrastructure like street connectivity, crossing signs, street trees, and architecture details.³⁷

Exclusive Bus Lane

A very effective technique to shorten the bus journey timeframe is by setting up an exclusive bus lane. This will enable the bus to bypass congestions during rush hours and increase user satisfaction.³⁸

CONCLUSION

Considerable environmental, health, economic and social gains could be achieved by replacing private cars with a combination of walking, cycling and public transportation.

This research provides a proposal for the currently sprawling city of Muscat to increase the attraction and competitiveness of public transportation. The proposal combines elements of urban planning, a type of compact neighborhood, landscape design, enjoyable walking experience, and the use of green technology like electric vehicles. Achieving this vision requires strong support from policy makers, public health authorities, city planners, local media, educational institutions, and most importantly, acceptance from the public.

NOTES

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DESIGN STRATEGIES FOR NATURAL CARE ENVIRONMENTS FOR PEOPLE WITH DEMENTIA: THE CASE STUDY OF CASCINA GRACE

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INTRODUCTION

The COVID-19 pandemic is a huge threat to global health, and the lockdown measures have proved effective in stopping the spread of the COVID-19 virus. The COVID-19 pandemic lockdown, on the other hand, has a lot of detrimental repercussions, particularly for mental health.¹ Older people, particularly those with dementia, are more vulnerable to the impacts of the epidemic and its attendant lockdown due to a lack of stimulation, social contact, and higher levels of worry and sadness.^{2,3}

Contact with nature can help people cope with the psychological effects of the COVID-19 pandemic, especially PWD in care facilities. Nature has been demonstrated to have restorative and healing properties.^{4,5} Human-nature interactions can elicit beneficial physiological, psychological, and emotional responses.⁶ Previous research has demonstrated that exposure to a green environment can assist PWD in coping with stress,⁷ overcoming behavior barriers,⁸,⁹ and generally improving their well-being,^{10,11} activity,¹² and identity.^{13,14,15} In addition to that, the outdoor space is one of the physical factors that contribute to the sense of home for PWD in care facilities.¹⁶

In the design of small-scale & homelike dementia care facilities, outdoor environments, such as sensory gardens, therapeutic gardens, or wandering gardens, have become an important feature.^{17,18} These gardens were established to promote the therapeutic benefits of contact with nature for PWD.¹⁹ There is evidence that outdoor spaces designed in the style of a garden in care institutions are underutilized.²⁰ The majority of PWD rarely initiate access to care facility gardens, preferring to remain in enclosed spaces. Even when activity interventions are conducted in the garden with the assistance of professional therapists, contact with nature is not spontaneous and continuous for them. This separation between nature contact and daily life may prevent PWD from truly integrating with nature. In general, gardens do not allow PWD to truly immerse themselves in nature, but rather serve as a supporting facility that increases their nature contact.

In addition to the garden, the green care farm (GCF) represents an innovative small-scale & homelike care facility design that allows PWD to actively live in the nature, and experience it though meaningful "active interactions".

This paper presents a pilot study focused on the development of intergenerational nature-based habitual activities (INBHA) supported by a physical system of small living spaces, within the context of a GCF facility. This pilot study is aimed at engaging people with dementia into an intergenerational psycho-social environment, animated by activities in contact with nature resembling past habits,

supporting mobility, autonomy and well-being of PWD, enhancing the recreation of a sense of home towards the environment through performing habitual activities, especially after experiencing stressful experiences such as lockdown measures during COVID-19 pandemic.

GREEN CARE FARMS (GCFs)

As dementia care has developed towards person-centered care, a growing number of small-scale, homelike care environments have been created worldwide.²¹ The Green Care Farm is one of these. The term "green care farm" refers to a small group of residents (e.g., persons with learning disabilities, psychological issues, substance abuse issues, and people with dementia) who live together on farmland in a "residence",²² and provide daycare for a variety of client groups with the goal of enhancing an individual's social, emotional, and educational well-being.²³

In this new approach to health (care), health is not only seen as the absence of disease but rather emphasizes the "ability to adapt to the disease and to self-manage".²⁴ PWD who live in a GCF have the opportunity to participate in a variety of activities, including domestic activities (washing dishes, preparing dinner, setting the table) and work-related activities (feeding the animals, cleaning the yard or stables, gardening) to social activities (coffee breaks, dinners, conversations) and leisure/recreational activities.

NATURE-BASED HABITUAL ACTIVITIES AND SENSE OF HOME

In GCFs, PWD are given a sense of home by carrying out habitual activities associated with their previous lives. In fact, for later life, the meaning of home often means the intimate relationship with the surroundings established by living in one place for a long time.²⁵ However, this intimate relationship is always broken for PWD, while facing relocation in the middle to late stages. After relocating, the elderly residents can regain a sense of home in a new environment through re-establishing the process of this people-space intimate relationship through bodily habitual activities. Many studies have shown that bodily habitual activities rooted in a specific environment over time and space, can transform that environment into a meaningful place with attachment for them.^{26,27} As a result, when PWD participate in activities on the Green Care Farm, such as farming, planting flowers and plants, taking care of animals, and other activities (hereafter called "nature-based habitual activities") that they used to do, an intimate relationship with the place can be established. Thus, due to the GCF's unique physical characteristics, such as its more abundant outdoor spaces and indoor spaces with easier contact with outdoors, PWD are constantly encouraged to engage in nature-based habitual activities.

METHODS

Cascina grace: a pilot case study

CASCINA GRACE is the first GCF for dementia in the city of Milan. It is located inside Casa Chiaravalle, a property confiscated from organized crime in Lombardy and entrusted to a consortium of 4 social enterprises active in the care of PWD and children. Casa Chiaravalle is a farmhouse encompassing about 2 hectares of woodland and 6 hectares of farmland; the land on which it stands is partly garden, and farmland. At the beginning of August 2021, it has been turned into a social care facility for a community of frail individuals encompassing PWD, orphans, families with low incomes and people with disabilities, under the management of the above-mentioned consortium of social enterprises. In particular, one of the two main villas in Casa Chiaravalle, welcomes a small community of elderly with medium/severe dementia due to Alzheimer's Disease (AD). This facility is called CASCINA GRACE. Therapists and caregivers organize care activities related to gardening and

in strict contact with the surrounding nature. Moreover, the presence of children allows the activation of intergenerational activities, which not only have a therapeutic and occupational purpose for the elderly, but they also represent an occasion for meeting, collaboration and construction of relations among all the inhabitants of Casa Chiaravalle.

Research framework & new elements

A recent paper by De Bruin et al. introduced a framework describing valuable characteristics of GCFs, in which they distinguish themselves from other long-term care facilities, on different levels of the health system based on existing literature.²⁸ In particular, the "micro" level refers to the psychosocial environment including the interactions between staff and the person with dementia, the alignment of social activities with culture, habits and preferences of the residents, freedom of choice regarding everyday activities and the degree of stimulation proposed to PWD. Accordingly, the "meso" level refers to the organizational context including care delivery approach, activities typologies and schedule, but also to the direct care environment such as the physical environment, its ambiance and services. As represented in Figure 1, based on the framework proposed by De Bruin et al., the development of CASCINA GRACE introduced new valuable characteristics related to "micro" level and "meso" level (highlighted in violet in Figure 1).



Figure 1. New elements introduced in the framework based on De Bruin et al. (2017)

In particular, regarding the "micro" level, in CASCINA GRACE we focused on the introduction of intergenerational nature-based habitual activities (INBHA). Those activities include: planting small potted plants and flowers, small farming, caring for farm animals, feeding and caring for horses and contemplative storytelling in the forest, all performed involving PWD and children.

Accordingly, in the pilot study presented, the new framework elements in the "meso" level are focused on the development of a system of small movable spaces to support INBHA. This system encompass wooden paths equipped with handrails, planting stations for small groups equipped with fabric coverage, benches, planting table, small wooden structures resembling a house archetype equipped with movable fabric coverage, settings, integrated handrails.

INBHA are supported by a physical system of small spaces which aims at enhancing autonomy, mobility, and recognition of the relationship space-function. Moreover, their homelike appearance and the performing of nature-based activities resembling past habitual ones should support the creation of a sense of intimacy and recognition towards the care environment.

OBSERVATION AND DATA COLLECTION

The study conducted can be defined as an in-depth study that comprises observation of PWD during and after the performing of INBHA. Therapists organised morning sessions of activities in the system of small spaces specifically designed, while in the afternoon all the residents were free to spontaneously interact with the physical system.

15 residents with dementia took part into the activities, involving mainly PWD with Mild and Moderate dementia, and only a few with Severe Dementia. Participants ranged in age from 69 to 82 years, involving both women and men. Previously, all the elderly involved undertook a mini-mental state exam (MMSE). The MMSE was used to provide an overall picture of cognitive status and dementia severity and produced a range from 12 to 25 where lower scores correspond to greater dementia severity.²⁹ Moreover, 5 young kids, aged between 7 and 12, participated in the above-mentioned activities.

Participants were divided into small intergenerational groups of 6-8 persons, according to personal preferences and freedom of choice regarding the specific INBHA organised by therapists. The small groups were accompanied through the garden to the designated point where the INBHA was carried on. Design researchers participated in INBHA as observers. Moreover, observations were undertaken during the rest of the day, in order to collect data regarding spontaneous activities taking place in the physical system, involving PWD and kids. During INBHA, comments made by participants, in the form of non-verbal gestures and verbal communications, were collected and lately analyzed to understand the overall reactions. In particular, the INBHA were audio-recorded, to be further analysed by design researchers. In particular, the observations were focused on 1 session of planting small potted flowers (session 1), 1 session of caring for courtyard animals (session 2) and 1 contemplative storytelling in the woods session (session 3).

During Session 1, the participants were introduced by therapists to the use of small pots to plant flowers. All participants were seated in the small wooden space specifically designed for the activity. Children were paired with PWD, so that each "couple" could focus on planting together one flower in a pot. Initially, therapists showed simple gestures necessary to plant the flowers. Consequently, each couple repeated the gestures. Many of the elderly started to reminisce, spontaneously telling old stories, giving advice to the children on how to use the soil, etc. Most of the children were interested in following advice and stories. Comments like "I feel good", "I like to be here, I like the smell", "this place is nice", "I remember being here" "I like this child" were expressed by PWD.

Session 2 encompass feeding chickens and hens and cleaning their barnyard. PWD were mostly involved in feeding activities, while children more actively helped in feeding and cleaning. A light system of red fabric tensed coverage delineated the area where these activities were taking place, acting as a spatial point of reference for PWD. PWD spontaneously started to show children how to take care of hens, supported by therapists. Children repeated those gestures asking for old stories. The elderly expressed comments like "I used to do that", "I like it", "I'm so happy", "I feel like home". Therapists noticed that a couple of elderly with difficulties in expressing verbal comments, while performing these activities were smiling a lot, moving arms as a sign of approval and happiness.

During session 3 a group of 5 PWD and 3 children reached one of the small wooden structures resembling a house archetype equipped with movable fabric coverage, settings, and integrated

handrails placed in the wood. All the group walked on one of the wooden paths and seated under the wooden construction. Therapists engaged PWD and children in contemplating and relaxing activities in contact with the surrounding nature. Aim of this activity was to enhance relaxation. Initially, PWD and children, assisted by therapists, took a walk around the wooden structure equipped with handrails, in order to explore and contemplate nature. Then, all the group took a seat and therapists introduced a contemplative activity focused on describing personal sensations, feelings, etc. PWD expressed comments like "It's so quiet here", "I like being here", "It is beautiful", "I feel very good" "I don't want to go away". Moreover, 3 of them started to reminisce about the past. 2 PWD fell asleep, and therapists highlighted this event as positive. Children were asked to imagine stories related to the surrounding nature, and elderly participated asking few questions.

After the sessions, design researchers observatory different spontaneous interactions with the system of mobile small places installed in the nature surrounding CASCINA GRACE. 4 elderly asked to take a walk on the paths. 2 elderly spent one hour seated under the wooden small house archetype in the wood. As well, 5 children played games in it, before dinner time. In general, design researchers and therapists noticed that elderly were more active, and spent more time in the wooden movable structures, rather then spending free time inside the facility. Children spontaneously, decorated some of the structures with small handmade objects.

The majority of the participants involved showed interest and curiosity for the activities proposed, willing to participate and contribute. PWD clearly understood how to use the wooden structures, and felt generally comfortable while seating or walking in the wooden system of spaces. Only 2 elderly felt uncomfortable while seating under one of the covered space, and were accompanied inside the facility by therapists. While walking on the wooden paths only 1 elderly felt confused and disoriented. During observations elderly with dementia actively interacted with each other, the therapists and the kids involved in the INBHA. Moreover, sometimes the residents involved became emotionally affected by some objects that were able to trigger past pleasant memories. Many elderly started to reminisce past memories and stories, and in the majority of times kids carefully listened to their stories.

RESULTS & DISCUSSION

The pilot study was conducted with a small sample of participants due to the limited number of PWD attending the daycare center involved in this research. Taking into account this limitation, the results are promising, and a sample size of 15 represents statistical significance in this pilot study. Accordingly, future studies with larger sample sizes have the potential to show results even more significant.

Key findings of this pilot study are that INBHA, supported by a system of small mobile spaces, positively affect the majority of the participants. Pleasure and positive mood were clearly identified among the majority of the participants. The observations undertaken during and after the activities represented an initial attempt to evaluate qualitatively the mood among participants. All the elderly involved were showing past experiences connected to nature-based activities. Many of them were showing lack of willing to participate into outdoor physical activities, if related only to physical movement. Moreover, the majority of them were experiencing apathy and lack of consistent social interactions with the staff or other residents. Their spontaneous interactions during the INBHA, and in some cases, their interactions with young kid even telling them old memories and stories, may represent that INBHA could be recognised as a promising tools for GCFs therapies for dementia.

Also, the physical system designed to support INBHA may be a promising tool. People with dementia asking therapists to take a walk "on the paths" represent an increase in positive mood and active life,

and moreover a successful attempt to increase mobility due to an enhancement of confidence and autonomy. The small wooden structures for contemplative storytelling were positively experienced by elderly with dementia, as well as young kids. During the day many of them spent time inside those wooden structures even if there were no specific activities taking place in them. This phenomenon could represent a positive response towards the enhancement of well-being in the residents.

This pilot study, gives support to the hypothesis that INBHA may enhance social engagement, positive mood, and active life in PWD, recreating a sense of home in PWD relocated from a previous care context. Moreover, the system of outdoor small spaces may support independence, orientation and mobility in PWD, while caring on INBHA.

CONCLUSION

The pilot case study described in this paper presents and discuss additional elements to the "micro" and "meso" levels proposed in De Bruin framework (2017) aimed at identifying key characteristics of GCFs. Thus, CASCINA GRACE GCF provides a broader spectrum of "active interactions" with nature, in the form of INBHA, than traditional GCFs environments. They are supported by a system of reconfigurable small movable spaces specifically design to enhance mobility, autonomy and the recognition of the aforementioned activities. CASCINA GRACE GCF takes the remaining capacities of PWD as a starting point rather than their limitations. Moreover, the unique psychosocial context provides the occasion for INBHA, which represents a key element to engage people with dementia, to stimulate a sense of intimacy towards the environment, and to create a stimulating psycho-social environment, animated by activities in contact with nature that remind them of past habits.

In conclusion, residents of CASCINA GRACE displayed a more active daily life, were more socially active, and well prepared to be involved in activities with children. The system of physical small spaces designed to support INBHA successfully contributed to enhancing mobility, confidence and intimacy towards the environment. INBHA represented a mutual occasion for learning, exchange of knowledge between elderly and younger generations, and the occasion to involve people with dementia in meaningful activities, fostering their autonomy, dignity, self-awareness and supporting their well-being, and the recreation of a sense of home towards the care environment.

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(CL)ADDING THE BALCONY WALL AS BREATHING ENVELOPE FOR HOUSING: THE REHABILITATION OF PHYSICAL AND MENTAL HEALTH

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INTRODUCTION



Figure 1. Encouragements from the Balconies in Italy during lockdown. 2021 (L) Social Network Services. Media as the new Balcony today. KakaoTalk Face Talk (mobile application), Roblox online game platform, 2021 (R)

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I pondered: What borders, walls and barriers have been strengthened as a result of lockdowns and physical distancing? Due to the pandemic, which has caused countless people to stay inside and work from home, sick building syndrome³ has become relevant to architecture. Stressful and environmentally threatening situations such as insufficient sanitation, climate change, pandemics, diseases and air pollution in cities provoke bodily responses, causing people to react quickly to protect ourselves. A carefully orchestrated and instantaneous architectural response will help people fight off the threat or flee to safety.

Before noting some of the key arguments for the balcony space, it is necessary to understand why the balcony needs to be re-examined today, especially for large residential complexes (apartments) and even for houses. As shown in the Figure 1 Left, the balcony has been used as an architectural breathing envelope in Italy in the face of the lockdown situation. This paper aims to investigate the balcony as an acute frontline defence that protects humans from indoor environments that threaten our physical and mental health. Recently, in South Korea, there has been a desire for alternatives to balconies, such as rooftop spaces or sun-terrace garden spaces, to find a way out of these COVID-19 difficulties. What is more, Social Network Services (SNSs) have acted as an open connection portal to the world, like a balcony, one of the elements of architecture. Through SNSs, Zoom, Roblox game, or Kakao Talk (mobile messenger), with the support of the internet and Wi-Fi, it has been possible to connect to the world (Figure 1 Right). This raises the following question: Is extensive media enough in response to the sick building syndrome caused by today's unhealthy indoor environments?

A case study approach is used in this paper. This paper is useful in understanding the architect's intervention in response to the environmental condition and concerns; including unhealthy environments, particularly in domestic balcony wall as "breathing envelope" narrative. By addressing this, it is possible to answer to a question of why the balcony needs to be restored to rehabilitate physical and mental health. This paper profitably propose a theoretical framework for understanding the transformation of the balcony space for housing, primarily the influence of unhealthy environments today. By examining different types of balconies in the apartment and even in houses and theories, this paper enters their relationship with the balcony and the existing conditions/environments. In Chapter 2, death of the balcony in South Korea apartment were investigated alongside with the 1960s apartments with the balcony. Chapter 3 features a historical analysis of Le Corbusier's cell-like individual apartments including Loggia/Balcony in the 1960s. Finally, Lacaton and Vassal's balcony wall addition in social housing were explored.

DEATH OF THE BALCONY IN SOUTH KOREA: ELIMINATED BALCONY LEGALISED FOR THE APARTMENTS – TAX BREAK OR BONUS ROOM?

Given the balcony and housings centrality to this paper, the apartment balcony in South Korea deserves special mention. In 2006, 'balcony elimination' was legalised for the apartments in South Korea. In other words, it is legally possible to expand the indoor space as much as the balcony space, and the balcony as an extension of the indoor space has been practised by architects in South Korea since 2006. According to the floor plans of Korean apartments in the 1960s, for instance. Mapo Apartment (Figure 2 Left) the first apartment house in South Korea, exotic balconies were added to accommodate a larger breathing spaces within the cell of the apartments. The apartments in Korea in the 1960s were directly or indirectly influenced by Le Corbusier's Unité d'Habitation, just like most of the apartment buildings in the world during that time. However, this is an example of a housing, especially an apartment cell that the balcony no longer exists (Figure 2 Right). Nonetheless, these balconies, now considered unnecessary spaces, are gradually disappearing. The question is why balconies in Korea were not wanted and therefore needed to be legally subtracted from indoor spaces by amending the law. Builders have created more balcony space since 2006, with the idea of

expanding this space afterwards, but they recognised in advance that the balcony space would eventually become indoor space. When analysing balcony laws and regulations in other states, such as those in Singapore, Japan and Germany, it is notable that balconies in these states are legally protected and, for certain sizes or less, excluded from floor area calculations; this indicates that balcony spaces are highly appreciated. Thus, this paper intends to focus on the subtracted balcony in South Korea during this time; the aim is to reinvent fundamental architectural elements (the balcony) that are disappearing, to prove the need for them and to restore them.



Figure 2. The First of the Complex-Type Apartment in Seoul, Mapo apartments, 1964^4 (L) Apartment plan regarding the Balcony extension in South Korea since 1960 until 2010.⁵ (R)

"Numaru", Traditional architectural breathing spaces in South Korea

To address the appropriation of the balcony in South Korea, it was essential to review traditional Korean architectural spaces that are similar to the balcony, thereby establishing ideas that pertain to public needs in Korea. There are *toenmaru* or *numaru* spaces in Korea that can be considered similar to the balcony or the transitional space, in the West. Since ancient times, there have been spaces connecting the inside and the outside in traditional Korean buildings, effectively acting as balconies. These traditional architectural devices are called *toenmaru* or *numaru* (Figure 3) in *hanok*, traditional architecture, and they are often covered with *hanok* eaves. Until the 19th century, there were not many tall buildings or apartments and peripheral spaces were emphasised in Korea. However, unlike traditional buildings, such spaces began to disappear as apartments started to be preferred in Korea. The balcony could have been replaced, but the architectural law was amended to eliminate balcony space altogether and to secure more indoor space instead.



Figure 3. Numaru in "Nongam Head House", Korean traditional building."6

The addition of the strip and creates its own border

Considering unanswered questions arising from the balcony law amendment, this research aims to supplement the current balcony act (Figure 4 Left) in South Korea. Seoul City Hall and architectural offices in Seoul have begun to attempt to find the appropriate ratio for current apartment balcony spaces. It is difficult to set back a law once it has been changed. Seoul City Hall, Korea-based architectural corporations and professor in architecture are all trying to supplement the balcony law. Thus, examining the balcony affords a discussion of a healthy environment that could be provided architecturally to ameliorate the tenuous mental and physical health of our time. As shown in the Figure, the question is what percentage of balcony space should be added to apartments in South Korea today. The goal is to manage, with the limited or inadequate means available, an addition of 20%, 25% or 30% (Figure 4 Right). This paper emphasises the need to restore the disappearing balcony space as a living space in South Korean apartments.



Figure 4. Subtracted Balcony, 2014⁷(L) versus Added Balcony concept, South Korea, 2021⁸ (R)

HISTORICAL TYPES OF A CELL WITH THE LOGGIA AND THE BALCONY: LE CORBUSIER

Model 1. "The Balcony-brise-soleil."9 Unité d'Habitation

Prior to the analysis of the balcony walls for housing in the 21st century, recognising the significance of balconies connected to the cells of apartment blocks of Le Corbusier in the 1960s is key to gaining a complete understanding of the balcony wall's progression and evolution within large residential complexes. In particular, it is worthwhile to highlight Unité d'Habitation's balcony walls (Figure 5-1 and 5-2) - as Le Corbusier explained in Modulor 2, 'The brise-soleil creates shade on glass in summer and, in winter, allows the sun to penetrate into the depth of the room, Socrates had already spoken of it, calling it 'the portico'. Thenceforth the glass panel becomes a feature of individual usages right in the midst of the agglomeration that is an 'unité d'habitation'. The balcony-brise-soleil, becoming a porch, becoming a loggia, enables each tenant to control his own window space both inside and out: cleaning, choice of curtains, etc.'10 It occupies the most important space of one of the most influential houses of the 1950-60s, demonstrating the priorities of the dwellings of Le Corbusier and beyond. A living cell, an example of a "Machine à Habiter"¹¹ with the balcony walls where reason and the heart can be satisfied was reproduced and became the architectural model of a "temple to family life"¹²appropriate to the evolving situation and urban environment. Charles Jencks, an American architectural historian and a theorist admired that the Unité d'Habitation's appropriate proportion, just like the Parthenon, brings the fullness, even dignity, of each constructional element: 'The Unité is in every way as keen, sharp and terrifying as the Parthenon.'¹³ Jencks further explained that the breathing spaces especially played a key role in providing the ideal interior space within a large residential area: 'All in all, the Unité was intended to be a radical alternative to suburban sprawl, where groups of 1,600 people form a manageably-sized association that gives the benefits of individual privacy and collective participation in one unity.¹⁴ In order to maintain the healthy communal life, securing the breathing spaces within a living cell was the ideal concept of the apartments in the 1960s. A large number of these cell-types were arranged according to a communal life and domesticity, and the lungs of the building have ensured the breathing of each cell. In addition, these spaces are bound together like a small village yet no individuality is sacrificed as in a small town and improved the circulation and secure the spaces for sports. The cell composited by the combination of the elements of the house advanced as the standard became a typical dwelling, good for the city or the countryside.



Figure 5. Level of the interior street. Each typical apartment floor comprises three levels. The interior street is located on the intermediate level. Each apartment comprises two levels and occupies one bay at the level of the interior street and one, two or three bays on either the upper or lower level.¹⁵

Model 2. A living cell with the Loggia and the Balcony, Immeubles-villas

In fact, Le Corbusier's *immeubles-villas* in the 1920s preceded the Unité d'Habitation's balcony wall. The key to extrapolating from a unique case to a set of methodological questions applicable to other architecture requires acknowledging the importance of *immeubles-villas*. In the 1920s, Le Corbusier

accommodated communal life in *immeubles-villas*, offering a new way of living in a big city. He proposed a new formula for urban dwelling: a minimum housing (cell) with their own loggias and balconies (Figure 6). Each cell of the apartment block is a small house, like a capsule, with its own garden, located at any height above the street. The injection of the loggia indoors and the inclusion of the balcony on the periphery were ironic for mass-produced cell units, but Le Corbusier's idea afforded the horizontal and diagonal growth of the cells, providing breathing spaces within large, multi-storey apartment blocks. Trees enter the house, giving life to the cell, and the loggia spaces promote diversity among cells within the apartment block. This opportunity breaks regular, formal layouts, creating irregular spaces that secure diversification and individuality.



Figure 6. The Loggia and the Balcony of the apartments from Immeubles-villas, Le Corbusier, 1925.¹⁶

Not only does the loggia express its formal connection to the breathing spaces in the cell, but the balcony is also standing for an essential space for interaction among architecture, the city, and the world.in the *immeubles-villas*. Each cell of the apartment is considered a small house with a tree. Through the balcony, maximal views of surrounding landscapes are collected indoors. The balcony thus gives an apartment a very individualised exterior space. Moreover, the balcony provides shelter on a smaller scale and affords healthy opportunities for social integration on a larger scale; this is why the balcony was planned. *Immeubles-villas* and their advanced types profitably proposed a framework for understanding the need for the restoration of the balcony to connect people with the city and the world.





Figure 7. Pavillon de l'Esprit Nouveau, Paris, France, from outside to inside, 1925¹⁷ (L) Villa Stein (Garches, France), Le Corbusier, covered terrace on the first floor, 1927¹⁸ (R).

Immeubles-villas was soon realised (life-sized) as the *Pavillon de l'Esprit Nouveau* (Figure 7 Left). A new scale was given to the *Pavillon de l'Esprit Nouveau*, the two-storey living unit with a quarter of the terrace built in response to human physiological and sentimental requirements. As Le Corbusier insisted, '*The "Pavillon de l'Esprit Nouveau" was accordingly designed as a typical cell-unit in just such a block of multiple villa-flats It consisted of a minimum dwelling with its own roof-terrace.*¹⁹ Thus the pavilion aims to provide breathing space in a closed cube through an internalised outdoor space. Furthermore, the realisation of the *immeubles-villas* was a proper preparation, as the spaces were becoming vaster as time went by. The prefabricated cells appeared as models for communal houses. *Immeubles-villas* underwent many transformations, and their various types became some of the basic apartment and housing cells of the 1920s, including Villa Stein (Figure 7 Right). The eventual solution of the healthy housing, based on an expanded version of the concept for the *immeubles-villas*, has been widely regarded as one of Le Corbusier's most sophisticated and enthralling compositions. The richness of one's house is not dependent on luxurious materials but rather the architect must work with the certainty of getting to the appropriate orders and strictly proportioning the independent elements of architecture, such as the balcony.

CONTEMPORARY CASE. HOUSING EXTENSIONS: ANNE LACATON & JEAN-PHILIPPE VASSAL

Make do and Individuality in the Apartment



Figure 8. The initial plan of the transformed stated of a residential tower "Lacaton and Vassal" (2005-2011)²⁰

An initial examination of the importance of understanding recent balcony restoration is necessary. Such research is beneficial in deepening our understanding of the apartments as they reflect the need at that time. What will become apparent in this section is a strategy of any reform, removal, regulation or reinvention of the dwelling. By addressing Lacaton and Vassal's *transformation de 530 logement* in France in 2017, the hope is that this research has delineated the significant importance of the reinvention of micro-territories: the balcony wall as breathing envelope. The Figure 8 is a photo showing the extension process of adding balcony space to social housing: the strategies of make do as explained by Lacaton and Vassal: 'Making do is about using what we already have. It is about considering the existing as a valuable resource, not as unsatisfactory or constraining.'²¹ The transformative micro-territories of the dwellings were based on the site-specific conditions and environments to give new qualities by re-inventorying the existing qualities that should be preserved

with precision and care, and what is missing that must be supplemented. The point here is to recognise the radical and successful practices of the restoration and transformation of the existing social housings' balconies in France in 2017.

The Strategies of the Plus. Existing + Extensions 44 210 m^2 existing + 23 500 m^2 extensions (68 000 m^2 winter gardens included)



Figure 9. Transformation de 530 logements, Bordeaux, France. Lacaton & Vassal, 2017²²

Lacaton and Vassal's transformation of 530 dwellings in Bordeaux, France, in 2017 demonstrates one of their strategies successfully. Instead of eliminating the given environment, Lacaton and Vassal aimed to reinvent the environment in response to an evolving situation. They explained their space strategies as follows: 'with a strategy of conversion of the existing spaces-through accumulation, addition and association-constitutes an attitude, as we see it, that is very receptive when it comes to building a city. Working with housing is doing urbanism.'²³ Their project also aimed to supplement what is lacking in the existing environment. The balcony is attached to the facade, and the addition of winter gardens, extending the existing space, gives the opportunity for each apartment owner to go outside and enjoy more space, more natural light, more fluidity of use and a greater view (Figure 9). The project's central idea is transforming the existing building without making significant alterations to its structure, stairs or floors, instead proceeding with additions and extensions. The balcony's original meaning and purpose are thus re-established.

THE REHABILITATION OF PHYSICAL AND MENTAL HEALTH IS THE KEY PROBLEM FOR THE ARCHITECTURE AND SPACE OF OUR TIME.

The Manuel of Dwelling and the Healing Architecture: Le Corbusier and Alvar Aalto

After all, the central question is what space is needed for the dwellings today. Taking Le Corbusier's idea of the dwelling further from *The Manual of the Dwelling* (1923), he also pointed out the significance of the balcony wall as breathing space for physical and mental health: 'One wall to be entirely glazed, opening if possible onto a balcony for sunbaths; the most up-to-date fittings with a shower-bath and gymnastic appliances.'²⁴ – as important as a bathroom. Following Le Corbusier, in the 1930s, Alvar Aalto's Paimio Sanatorium sun terrace (Figure 10) aimed to promote physical and psychological well-being, and this sun terrace was considered a medically critical space. Aalto's sun terrace provided natural remedies to help the body heal itself, offering architectural and medical

support as possible ways to recover mentally and physically. Healing architecture is fundamentally a matter of housing eventually, from the beginning to the end, and the balcony represents an important stage – a stage in which comfort, desire and architectural aesthetics are brought together. When I ask what is needed for today's architecture, I suggest rehabilitating our relationship with the balcony space, not only for aesthetic pleasure but also because, due to the unhealthy environments of our times, such a space needs to be re-evaluated in terms of physical and mental health.



Figure 10. The Healing Architecture Sections. Scale 1:500²⁵ (L)showing "Sun-terrace" of the Paimio Sanatorium, Alvar Aalto, 1932.²⁶

To the City and to the World, From the Balcony

'*Urbi et orbi*'²⁷ means to the city and to the world. The pope delivers his words to Catholics in the city of Rome and around the world from his balcony. In such moments, the balcony becomes a monumental or sacred element of architecture. Italian politician Benito Mussolini declared war from the balcony of the Palazzo Venezia, the headquarters of his fascist government. That balcony is no longer being used; however, its power remains because Mussolini reconstructed a part of the city to secure a view of the Colosseum from that balcony - the most powerful balcony in history. The balcony was needed to pull together what was around it, and it also extends its reach with the support of media technologies. This element of architecture has indeed transformed people's relationships with the city and with the world.

CONCLUSION

The balcony addition and transformation encompasses more than just a balcony as an architectural element; the balcony wall as breathing envelope helps to create the best of what could be achieved of the dwelling and to rehabilitate physical and mental health and to focus on providing an efficient and good environment within which all residents could live comfortably, safely and with dignity. This paper has explored the integral relationship between the balcony wall and healthy dwelling. In conclusion, the transformation of dwelling through the addition of balcony walls as breathing envelope is necessary for the apartment in South Korea today. Moreover, the balcony has allowed people to continue their relationship with the spaces outside their buildings, such as the city or the world. Finally, investing in the balcony turned out to be an investment in healthy architecture of our time. Especially for large residential complexes, such as apartment blocks, if we do not commit to improving balcony spaces, the future of such housing and the cities that surround it may be desolate.

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NOTES

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³³ Symptoms of sick building syndrome and building related illness (BRI) are: SBS: mucous membrane irritation: eye, nose, and throat irritation; Neurotoxic effects: headaches, mental fatigue, reduced memory, nausea, tiredness, dizziness, and irritability; Asthma and asthma-like symptoms: chest tightness and wheezing; Skin dryness and irritation, gastrointestinal complaints, and others. BRI: flu: fever, chills, chest tightness, muscle aches and cough, Legionnaires' disease, hypersensitivity pneumonitis, humidifier fever, Lung and Respiratory problems. (Reference. Tran Vihn, Park, Duck-shin, Lee, Young-Chul, *Indoor Air Pollution, Related Human Diseases, and Recent Trends in the Control and Improvement of Indoor Air Quality*, International Journal of Environmental Research and Public Health, 2020.)

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⁵ Hyunsu Shin, Donghoon Kim (2018). Architectural Institute of Korea. 38(1), 74.

⁶ Photograph taken by Nam, Sung-Taeg, Associate Professor, Hanyang University, Republic of Korea.

⁷ Hyundai 'Hillstate Apartment' Plan, South Korea, illustrating elimination of the balcony, 2014. (Reference. News media.)

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⁹ Le Corbusier, "Tool," in *Modulor* 2, trans. Peter de Francia and Anna Bostock. First published 1955 by Le Corbusier. 4th reprint 2018, 184.

¹⁰ Le Corbusier 184.

¹¹ Le Corbusier and Pierre Jeanneret, Œuvre complète, Volume 1, 1910-1929, 98.

¹² Jencks Charles, "Other Languages of Architecture." in *Le Corbusier and the Tragic View of Architecture*, (Massachusetts: Harvard University Press, 1973), 145.

¹³ ibid., 144.

¹⁴ ibid., 147.

¹⁵ Le Corbusier and Pierre Jeanneret, *Œuvre complète*, Volume 7, 1957-1965, 210.

¹⁶ Le Corbusier and Pierre Jeanneret, op.cit, 1910-1929, 43.

¹⁷ Le Corbusier and Pierre Jeanneret, op.cit, 1910-1929, 103.

¹⁸ ibid., 145.

¹⁹ ibid., 104.

²⁰ Lucan, Jacques, "La ville comme sédimentation," in *Habiter ville et architecture*, (EPFL Press, 2021), p.303.

²¹ Ruby, Ilka and Andreas, "Make Do," in *The Materials Book*, (Ruby Press, 2020), 58.

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²⁴ Le Corbusier, *Towards a New Architecture*, trans. Frederick Etchelles. First published in England 1927 by John Rodker. The Architectural Press facsimile edition 1946, 1948, 1952, 1956, 1959, 1963, 1965. First paperback edition 1970. Etchelles's translation of 1927 made from 13th French edition. Book originally published in Paris in 1923 by Éditions Crès under title *Vers une Architecture*, from articles appearing in *L'Espirit Nouveau* since October 1920, 114.

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FORM FOLLOWS FUNCTION FOR ALL: A PERFORMANCE-ORIENTED APPROACH TO SUPPORT SOCIAL INCLUSION IN THE BUILT ENVIRONMENT.

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INTRODUCTION

Mobility impairments, such as lower limb disorders and spinal cord injury, lead to considerable disruptions in functioning¹, especially the ability to traverse through places freely and easily. Mobility-related impairments are amongst the most common types of impairments worldwide, with approximately 25% of all impairments considered mobility-related². Despite the increase of users of mobility assistive devices (MobAD) in cities (e.g., wheelchairs), there has been a lack of accessibility in urban environments in many parts of the world.

Most studies carried out on physical accessibility of urban environments have focused on either exploring the medical implications of physical barriers³ or advancing assistive technologies and devices⁴. So far, very little attention has been paid to the role of spatial design as a barrier and a facilitator of accessible urban environments. The primary aim of our research was to explore how design can improve accessibility of public spaces for the benefit of MobAD users.

Our work follows a *research-by-design* overall approach. Research-by-design refers to studying design applications and substantiates new architectural knowledge, which arises from laboratory-type interventions⁵. This approach recognises two stages in terms of progressing the research narrative: (1) understanding the problem and (2) designing the solution for the previously defined problem. As such, in this paper we will initially identify physical obstacles in public spaces and prioritise those barriers based on the extend they inhibit MobAD users from accessing or using public spaces. Then, we will provide an overview of design strategies that we have deployed to address the phenomenon of physical inaccessibility.

STAGE A – CLARIFICATION OF DESIGN PROBLEM

Inaccessible spaces and the impact on MobAD users: a background investigation

We conducted a systematic review (currently under review for publication) on how inaccessible design of public spaces affects the quality of life, including aspects of health and safety, independence, and social participation, of MobAD users. We searched in three databases (i.e., Scopus, Web of Science, and PubMed) and analysed forty-eight peer-reviewed journal articles.

Findings indicated a substantial number of inaccessible elements for MobAD users in public spaces. Pathways, boarding ramps, entrance features, confined spaces, and service surfaces were deemed to be the least accessible elements. These barriers had multifaceted effects on MobAD users' quality-oflife with aspects of physical health, mobility, and use of public transport being most affected. Design characteristics of existing physical elements of public spaces were often found not to comply with accessibility guidelines. Height differences, limited widths, and excessive slope gradients were common factors for the observed incongruence. Moreover, review findings indicated that inflexible elements (such as concrete steps, stairs, and manual doors) can totally exclude MobAD users from public spaces or compel them to conform to unsafe or inconvenient spatial situations.

Assessing the accessibility of actual surroundings

To identify physical barriers in actual settings, we investigated spatial situations in urban environments and assessed their accessibility for MobAD users. Birmingham (UK) city-centre was selected as the field study area because of the significant population concentration and similar physical characteristics to other western cities – such as the mixed-use activities and dense environment. Figure 1 presents the study area in relation to the city of Birmingham.



Figure 8. Field study area in Birmingham city-centre.

For the purpose of the accessibility assessment, we conducted an access audit in the study area from July – August 2019. Access audits are forms of inspection that can be used to evaluate the ease of access to and use of buildings or outdoor spaces by disabled people⁶. We constructed access audit questionnaires to record data from direct observation and measurements of the most prominent public open spaces and buildings, which were found in the study area. We completed one questionnaire for every open space (e.g., a street) or building (e.g., a public library) that we assessed.

We utilised the *British Standard* 8300-1: 2018 - Design of an accessible and inclusive built environment as a reference document⁷. This is a widely adopted set of accessibility guidelines in a UK context, which provides technical recommendations on the design of physical elements in urban settings. We used a physical and a digital tape-measure to compare features of the observed spaces to the design standards.

Preliminary analysis indicated that approximately 40% of the observed spatial situations did not comply with accessibility standards. This considerably high rate is an alarming result, as it may be an indication that urban centres in the UK probably abound with physical obstacles for MobAD users. Transport physical facilities, such as train platforms and bus stops, had the lowest compliance rates overall. In terms of outdoor elements, pathways were found to be the least compliant feature, as more than half of them would not have the adequate width to facilitate MobAD characteristics. Regarding situations inside buildings, spatial arrangements had the lowest compliance rate across all sections.

This was mainly due to aisles of limited width or inconsiderate seating arrangements. Another striking issue was furniture accessibility, as most features found in dining or study spaces did not meet accessibility criteria regarding toes and knees clearances.

Defining physical barriers in public spaces according to MobAD users' perspective

To identify how MobAD users experience problematic public spaces, we conducted a social survey. A secondary aim of this study is to triangulate results from the systematic review and access audits, and therefore reinforce the credibility of collected evidence. The study design was reviewed by the University of Nottingham Ethics Committee. The survey received ethical approval in February 2020. We utilised digital survey forms to implement this study. A major advantage of conducting survey research online is the ability to reach difficult to contact individuals or individuals in distant locations⁸. We constructed a digital questionnaire in the Microsoft Forms online cloud, which remained active from March-May 2020. To ensure data reliability, fifty participants across the UK were recruited for this study. We examined participants' perceived difficulty with exercising everyday activities in the built environment (e.g., moving around outdoors, using public transport, or shopping). We also investigated MobAD users' perceived accessibility with certain spatial situations in various public spaces (e.g., a narrow pathway or a high library desk) according to the extend they accommodated their functioning capabilities.

Initial results showed that more than two thirds of the study population experienced severe difficulty when using public transport as well as getting around outdoors. Over half of the respondents struggled with shopping or using facilities and furniture in public buildings or stores. Most study participants considered boarding/alighting trains to be the most challenging situation, followed by accessing stepped entrances.

Design problem: negotiating physical gaps between trains and platforms

Aggregated findings from the above studies suggest that transport facilities are a source of inconvenience for MobAD users. Our access audit of Birmingham city-centre revealed that a significant number of transport facilities did not comply with accessibility guidelines. Specifically, rail physical infrastructure was considered problematic by a substantial proportion of the study population. Most respondents were particularly critical toward the interface between trains and platforms (or, *Platform Train Interface* – PTI), as they experienced a great deal of difficulty with boarding/alighting trains. These findings align with those of the systematic review, which suggested that boarding/alighting tasks can induce severe inconvenience and potentially physical danger to MobAD users. In most cases, this was due to physical gaps that develop at PTIs.

Existing gaps impede MobAD users from boarding trains in a safe and comfortable way, as they develop in greater dimensions than the acceptable range. Previous studies have suggested that the maximum acceptable gap that users of mobility assistive devices can negotiate themselves, without additional instruments, is 50x50 mm⁹. However, most gaps present in much larger proportions. Specifically, the biggest horizontal gap can be up to 450mm while the vertical gap can even reach 550mm, with distance measured from platform to floor. Figure 2 juxtaposes acceptable gap dimensions with those usually encountered in actual PTI settings.

In light of these lines of evidence, it becomes clear that spatial restrictions imposed by physical gaps at PTI settings is a major concern with respect to designing MobAD-accessible transport facilities. What follows is a brief overview of the design process that we followed in a bid to resolve this design problem.



Figure 9. Acceptable and actual physical gaps at PTIs.

STAGE B – DEVELOPMENT OF DESIGN INTERVENTION Investigation of the state-of-the-art

Several applications have been designed to address the research problem over the years, including boarding ramps, on-board lifts, and gap fillers. Boarding ramps is arguably the most widespread solution worldwide. Boarding ramps have a low cost and can accommodate different PTIs thanks to their high degree of transferability. In certain cases, however, they can be unsafe to many MobAD users due to their slippery surfaces and steep deployment angles¹⁰. Moreover, the fact that boarding ramps require deployment by a member of staff is likely to have negative consequences on MobAD users' autonomy.

In conjunction with applied interventions, we have discovered a few proposed – yet not implemented – design concepts. For instance, a self-retractable ramp seems to be a promising concept¹¹. This type of ramp can easily be bolted under a train doorstep and expand until it finds the platform level. The ramp can effectively bridge both horizontal and vertical gaps at straight or curved platforms. However, potential structural instability may be a drawback for this concept.

Platform extensions on predetermined areas have also been suggested as a potential solution¹². Some types can only bridge horizontal gaps while others can bridge both horizontal and vertical gaps. Those types that only operate for horizontal gaps might be unsafe and possibly misleading for MobAD users attempting to a negotiate a doorstep of higher level. A general shortcoming for platform extensions is their installation along the platform at predetermined spots, which requires incoming trains to stop at those positions. Moreover, it is improbable that different types of trains have been designed in such a way that could position train doors in front of the designated extensions.

Another type of proposed solutions refers to adaptable access ramps. In most cases, designers have proposed deployable, retractable and movable ramps, which could efficiently bridge both horizontal and vertical gaps ¹³. However, most of the reviewed ramp-type solutions lacked the sufficient length to provide a comfortable slope for MobAD users' boarding or alighting. Another limitation of this type of concepts is the fact that they require the presence of a conductor to operate, deploy, re-locate, or store the proposed ramps. This would hamper the autonomy of MobAD users or totally exclude them in some extreme cases – for instance, in unmanned stations.

Notwithstanding their shortcomings, adaptable ramps, platform extensions, and on-board ramps are deemed to be the most promising solutions. Based on those, the next part of our research explores novel design ideas – with some help from actual MobAD users – to later arrive at a usable and accessible solution for PTIs.

Wheeling to Transform: a platform for collaborative and inclusive design-thinking

To explore possible ideas and arrive at a usable design solution for PTIs, we invited users of MobAD to participate in our *design-thinking* cycle. Design-thinking has been described as an analytic, iterative, and creative process that connects designers and end-users in opportunities to ideate, test, prototype models, collect feedback, and redesign¹⁴. For design-thinking purposes of our research, we created *Wheeling to Transform*, an online platform for collaboration with members of the community. The platform consisted of a social media page, an online drawing canvas, and digital meeting rooms. These tools helped us engage with MobAD users in remote locations, conduct design experiments, and maximise the outreach of our research. Design-thinking activities as well as operations of the Wheeling to Transform platform were reviewed and approved by the University of Nottingham Research Ethics Committee in November 2020.

As previously stated, our design-thinking process was collaborative in nature. Collaborative creation refers to any act of collective creativity – i.e., creativity that is shared by two or more people¹⁵. In a design context, collaborative design (or, *co-design*) describes a multiplicity of creative activities, which involve designers and people not trained in design working together in the design-thinking process¹⁶. Following this approach, we recruited fifteen users of MobAD through the Wheeling to Transform platform as well as e-mail communication. Our objective was to discuss with them the most promising solutions, as emerged from findings of the state-of-the-art investigation, and collaboratively explore new types of interventions. We held a two-hour online meeting with each study participant. During those meetings, we displayed several design scenarios to study participants so as to create a conducive space for discussion and creative investigation. Figure 3 illustrates three example scenarios, which were examined with MobAD users.

Design scenarios along with participants' feedback and/or separate design suggestions remained online in the Wheeling to Transform platform until the completion of all co-design meetings. In this way, participants interacted with each other and engaged in a constructive dialogue, which was the main source of our design inspiration. After multiple consultations with MobAD users, the collective decision was that a temporary, on-demand installation on platforms would be the preferred solution from a users' perspective. Notwithstanding differences in functioning status and type of MobAD used, the majority of study participants would choose a type of self-deployable ramp over any other type of access intervention assisted or conducted by a third party. These findings indicated that independent boarding/alighting was a desirable quality for MobAD users, which should be addressed in our design proposition.

A striking observation from the co-design meetings was that the population sample was significantly heterogenous in terms of human performance and MobAD characteristics. For instance, some participants used manual wheelchairs while some others used a walking stick. A few participants reported a substantial difficulty with independently using their MobAD, as another cohort could not negotiate physical gaps between trains and platforms at all. It is, therefore, clear that the proposed solution should facilitate a wide range of human characteristics. To achieve inclusion with design, we incorporated elements from *universal design* into the design-thinking process. Universal design is an approach that accommodates and empowers a diverse population by improving health and wellbeing, human functioning, and social participation¹⁷. This approach harnesses empirical knowledge from anthropometrics and biomechanics to estimate spatial requirements for a wide spectrum of individuals by considering diverse functional capabilities¹⁸.



Figure 10. Examples of design scenarios discussed with MobAD users.

We conducted a series of measurement studies to become more conscious of different body dimensions, health conditions and types of assistive devices. We recruited another thirty MobAD users through the Wheeling to Transform platform as well as e-mail communication. We measured functioning characteristics relevant to design purposes – i.e., lateral reach range, gap and slope negotiation thresholds, and clear floor area requirements – for users of different types of MobAD. Results were then compared to in-person measurements conducted by other researchers¹⁹. In almost

all cases, our collected data agreed with findings of previous studies. In this way, we managed to identify the dimensional criteria for designing an access ramp, which would provide an equitable way to board/alight train carriages to all MobAD users regardless of the variations in functioning capabilities or device sizes.

Future work: incorporating human performance into design generation

Our work continues with the design development phase, in which we examine several design possibilities regarding the final form and operation of the prospective intervention. A crucial requirement is that the proposed intervention should be designed in a way to accommodate people with different functioning capabilities. Due to multiple and variable criteria (i.e., different body sizes and capabilities, platform restrictions, train characteristics), it has been extremely demanding to investigate suitable design forms by hand or via conventional CAD programs. Therefore, we turned to design optimisation algorithms to help us explore a wide range of design options. Design optimisation is a process that can conceptualise the optimal solution for a design among many alternatives, upon the application of numerous sets of performance parameters²⁰. In most cases, this is achieved through the development of algorithms in Building Information Modelling workspaces, as those can process multivariate performance parameters and produce manipulatable digital models dynamically²¹. Based on the collected data from measurement studies, we have considered varying sets of dimensional criteria as performance parameters. We are currently utilising optimisation algorithms as a means to explore alternative design forms in a bid to arrive at an optimal solution, which can satisfy most of (or, all, in the best case scenario) the performance parameters. This will enable us to maximise accessibility and usability of the proposed intervention in terms of accommodating MobAD users' functioning capabilities in an equitable way.

Previous findings indicated that the majority of MobAD users would favour a flexible solution that could help them negotiate PTIs independently. Corresponding to their preferences, we are looking to employ techniques from the field of *adaptive architecture* to create a self-deployable ramp-type structure. Adaptive architecture refers to the ability of elements of the built environment to adapt according to the needs or desires of their occupants²². Adaptive structures comprise dynamic configurations that can continuously change in form and function²³. In certain cases, adaptive elements have facilitated a diverse population through adapting to a wide range of functional capabilities. An exemplar of this approach is the adaptable platform of Stockholm Opera that functions as both an accessible lift and a flight of steps/stairs to accommodate MobAD users and non-disabled individuals (Figure 4). In a similar way, we intend to create a transferable and adaptive access ramp, which will enhance MobAD users' autonomy at PTIs.



Form A - accessible lift Reaching low level Transforming to steps Form B - stepped entrance Figure 11. Adaptable platform at Stockholm Opera. Courtesy of Guldmann Co.

CONCLUSION

In this paper, we have identified the most challenging physical obstacles in public spaces, which inhibit MobAD users from accessing or using public spaces. We found that spatial restrictions posed by physical gaps at PTI settings is a primary concern for designing MobAD-accessible transport facilities. We also provided an overview of the collaborative and universal design-thinking processes that we followed in a bid to improve MobAD-accessibility at PTIs. We intend to create an inclusive ramp-type structure, which will efficiently cover horizontal and vertical gaps at PTIs. To achieve this, we will utilise design optimisation algorithms and structural adaptation techniques.
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ENGAGEMENT BY DESIGN: HOW FOUR RESIDENTIAL GARDENS IN THE RANDSTAD (NL) STIMULATE HEALTHY INTERACTIONS BETWEEN INDIVIDUALS, COMMUNITY, AND PLACE

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INTRODUCTION

Gardens feature amongst the oldest enablers of contact with nature in cities and are known to carry restorative qualities, both to humans and non-humans.¹ Indeed, presence and access to urban green have long been acknowledged as contributing to health and well-being². Being exposed to a natural environment speeds recovery from stress³ and even the sound of nature has healing powers.⁴ Moreover, studies have shown the domestic gardens' contribution in providing ecosystem services: beyond their substantial value in augmenting urban biodiversity, gardens can help regulate temperature, reduce flood risks, and store considerable amounts of carbon.⁵ Gardens are also social environments, providing recreational and educational spaces for children and adults. In addition, collective gardens are stages for social connectedness and community building by fostering interpersonal and intercultural negotiation and collaboration.⁶

With ongoing urbanization and densification – accelerated by an increasing housing demand – and with decreasing accessibility of green in urban settings⁷, residential gardens could become key to promoting healthier and more resilient urban neighbourhoods,⁸ especially gardens with a collective character. However, little is known on the role of garden design and governance in facilitating and stimulating healthy interactions – or positive relationship – between individuals, community, and place. Research in this area has mostly focused on community gardens and allotment areas, while only a few address residential gardens.⁹

This contribution focuses on residential gardens with a partially collective character in medium-scale housing complexes in the Dutch Randstad metropolis, considering their design as products (layout, objects, experiential aspects) and processes (conception, construction, modifications). We investigate how garden design as-a-product and as-a-process can act as catalysts for community engagement, and as stages for positive interactions among inhabitants and with the place by identifying success factors and barriers. As such, this study contributes to research in landscape architecture, urban planning, and management in the built environment, and forwards design strategies that promote engagement between individuals and with the garden, thereby giving input to individual and community well-being in residential developments towards more resilient and healthy urban neighbourhoods.

Design principles for commons as framework for garden analysis

As green spaces collectively organized and managed by the residents, (semi-)collective residential gardens resemble Ostrom's concept of common-pool-resources (CPR)¹⁰, or simply "commons". Commons can be defined as natural or constructed systems in which it is costly to prevent individuals from benefiting from its resources and, in doing so, one individual reduces the resource availability for others.¹¹ Through extensive empirical work, Ostrom challenged Hardin's postulate on the tragedy of the commons¹² by demonstrating that communities could succeed in sustainably and locally self-governing CPRs by following eight design principles.¹² Although these principles relate to natural and complex environments, they have been widely studied, translated, and applied to different kinds of urban spaces and infrastructures – such as allotment areas, community gardens, and urban parks¹³ – as well as to the city as a whole.¹⁴ Although these urban green commons account for many publications about processes of self-governance, empirical works on urban commons are still in short supply,¹⁵ and largely disregard the potential of community governance in housing complexes.¹⁶

In the residential context, shared spaces such as stairways, corridors, and courtyards, have also been treated as commons, categorized as "residual residential spaces".¹⁷ We argue that, rather than mere residual spaces, gardens can be extremely relevant for community identity and empowerment, by facilitating, stimulating, and even provoking social engagement. As we envisioned that Ostrom's design principles also bring or lead to spatial implications, using them as a framework for garden analysis can orient this research not only from the governance perspective but also from a landscape architectural design perspective.

METHODS AND APPROACH

Our work adopts an exploratory case study approach¹⁸, as it allows us to investigate in-depth and compare multiple gardens within the study area. We discuss four residential gardens in recently constructed housing complexes in the Randstad – selected based on the presence of a collective garden and their variety in terms of location, housing market, use and level of citizen participation. As we aim to explore both garden design as-a-product and as-a-process, we adopted a multimethod approach, combining landscape architectural and governance analysis, from desk and field research, between March and October 2021.

From the landscape architectural design perspective, we analyzed the morphological, compositional, experiential, and functional aspects of the gardens, by means of plan analysis, field observations and unstructured interviews conducted with residents, visitors, and passersby. The construction of a timeline of the design and construction process helped us pinpoint important moments in the design process.

From the governance perspective, we consulted open datasets with current governmental geoinformation¹⁹, as well as examined the gardens' regulatory documents to understand the ownership of the land and how communities organize themselves, defining expectations for the use, maintenance, and modification of individual and collective areas. During the field visits, we took notes and records of self-government actions, while conducting informal interviews with residents and green committees.

Finally, semi-structured interviews were conducted with the garden designers to confirm, correct, and supplement the obtained information about the design process – requirements, concept, and participatory actions – and the design product – program, composition, structure, objects, experience. The comparison between desk and field analysis from the landscape architectural and governance perspective, combined through a single framework on design principles for governing the commons, helped us to explore the case studies as dynamic spaces, constantly changing over time.

Selected case studies

Ranging from 33 to 140 homes, mixing houses and apartments, the chosen housing developments are situated in different housing markets and their gardens display different gradients of individual and collective use. (Table 1)

Case study	Year	Location	Housing	Garden layout
А	2019	Utrecht, outskirts	51 owner occupied houses	individual gardens, private collective garden
В	2015	Purmerend, urbanized area	140 social rentals apartments	public collective garden
С	2009	Rotterdam, outskirts	24 social rentals, 36 owner- occupied housing; 28 apartments, 32 houses	individual gardens, public collective garden
D	2019	The Hague, urbanized area	33 owner occupied houses	individual gardens, private collective garden

Table 1. General information on the case studies



Figure 1. From left to right: case studies A, B, C and D. Plan legend (from darkest to lightest color): individual use, transition, and collective use

Although the case studies show unique layouts and are situated in their own contexts, they share a common design principle: the collective garden in the centre of the lot (Figure 1). We hypothesize that these gardens can be interpreted as residential commons and based their comparative analysis on Ostrom's design principles for governing the commons.²⁰ In light of each principle, two divergent case studies at a time are analyzed and compared. The comparison of contrasting cases supports this exploratory research to understand the success factors and barriers in facilitating engagement by design as-a-product and design as-a-process.

RESULTS

Clearly defined boundaries

Ostrom's first principle concerns the need for clearly defined boundaries between users and resources, which we translated as the garden space itself. We compare case studies A and C, consisting of individual gardens connected to a collective garden. Here, boundaries refer to the interfaces between individual and collective areas within the gardens.

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Figure 2. Boundaries in case studies A (left) and C (right)

In case study C, the boundaries were initially drawn by low walls or expressed by different ground surfaces. Years later, these boundaries have morphed into higher and higher fences in response to security requirements, which inhibits interactions between users and with the collective garden, and expresses reduced engagement over time. In case study A, the boundaries stretch across a green buffer, conceived after participatory meetings during the design process, as the participants were concerned about privacy. By structuring the space without the use of fences, this green buffer helps to create an integrated space. (Figure 2)

Establishing well-defined boundaries alone does not contribute to social engagement. However, the spatial configuration of these boundaries can be achieved without segregation of spaces, stimulating engagement through collaboration and visual approximation.

Congruence between appropriation and provision rules and local conditions

The second principle discusses the coherence between appropriation and provision rules – or that the use of the space needs to be consistent with residents' expectations, respecting the garden's characteristics. Once again, we compare case studies A and C. In both cases, residents maintain the collective garden themselves, although with different levels of engagement.

In case study A, flexible spaces accommodate different uses and answer to a wide range of residents' wishes. In addition, a long playful bench encourages multiple ways of engaging, such as playing and gathering, and the collective greenhouse acts as a collaborative space, where residents grow herbs and vegetables and share the harvest. In case study C, the spatial program of the collective garden encourages community life, such as a communal building and a vegetable garden. However, the use is regulated: playing with a hardball or making noise is not allowed and the vegetable garden, designed as a shared space, is a place for individual planting and harvesting. (Figure 3)

In case study A, the residents' effort spent on gardening is rewarded by the enjoyment of flexible spaces and engaging objects on multiple occasions – making gardening a pleasant and inviting social activity that concerns all residents. In contrast, in case study C, the predominantly contemplative garden only engages a small group of residents, because for some, the expectations of maintaining collective spaces are dissonant with those of their appropriation – or the enjoyment of the garden.



Figure 3. Use of collective gardens in case studies A (left) and C (right)

Collective-choice arrangements

According to the third principle, users should have procedures for making own rules. We translate this principle by relating it to participation in the design and transformation of the gardens, discussing case studies B and D.

Case study D is a product of a collective-private commissioning. The entire housing development, including the garden, was conceived, designed, and partially built by the residents themselves. Respecting the basic requirement of having as little paved surface as possible, households have autonomy to design the pathway to their private gardens. This created a multitude of solutions, which made the garden more dynamic, reflecting individuality within the community (Figure 4).



Figure 4. Pathways to private gardens in case study D

Case study B is a residential-care complex, composed entirely of social rentals. However, considering the inner garden would be open to the public, the design office built the garden prototype outside the construction site. By enjoying this temporary garden, the neighborhood provided input to feed the design process. For instance, a continuous wooden bench has been turned into several seating sets in the semi-private areas.

Both cases illustrate involvement during the design phase in two different contexts. In each case, to a greater or lesser degree, actions were taken to generate engagement between users and the garden – either through direct participation in the creation or transformation of these spaces, or indirectly, by engaging with the garden's prototype.

Regular monitoring of users and resource conditions

The fourth principle is about regular monitoring of users and resource conditions – which we applied to the space itself and to the usage of those spaces. In case studies, we observed that residents generally organized one "garden day" a month for gardening together.

In addition to regular gardening, in case study D, the residents built their permaculture-based garden together and in case study A, inhabitants worked on two heavy jobs themselves: installing green roofs and re-planting the entire garden, as the soil was poor in organic material. (Figure 5)

In both cases, regular monitoring of the garden is organized by means of collective gardening days. The collective actions go further: while strengthening residents' ties with the gardens and with each other, stimulate engagement and build up a sense of community.



Figure 5. Garden modifications on case studies A (top) and D (bottom)

Graduated sanctions

The fifth principle addresses the need of graduated sanctions to come into force when regulations are violated. In all case studies, there are documents that regulate the use, maintenance, and transformation of individual and collective gardens. When a conflict situation is not formally covered by these regulations, informal arrangements come up in common agreement between residents.

For instance, in case study D, the neighbors must agree on the appearance of the boundaries between their two individual gardens. In case of a conflict, an impartial fellow resident is put in charge to help find a mid-ground. In case study C, there is pressure from the community to keep the individual gardens in good shape. When that doesn't happen, neighbors volunteer to help with the gardening. Both examples concern private spaces that negatively impact the experience of the collective space, leading to proportional reactions from the community. The "sanctions" – or solutions taken by the two communities – end up provoking engagement among residents and with individual gardens.

Conflict-resolution mechanisms

For the sixth principle, which focuses on resolution mechanisms, we discuss case studies D and C. When one of the entrances was paved, cyclists started to enter the collective garden by bicycle, damaging the vegetation. Currently, the residents are transforming this access: they removed the pavement, narrowed the entrance by adding a piece of trunk, and are building a green arch to convey the idea of intimate space. This trial-and-error design is a tool to achieve the desired effect and contrasts with what happens in case study B. There, the gardening is done by the housing company, which led to loss of texture and simplification of garden's composition. (Figure 6)

In case study D, bottom-up decisions involve residents and generate engagement with the collective space, while in case study C, top-down decisions indicate low resident engagement with the garden over time.



Figure 6. Changing entrance in case study D (left); loss of texture in case study B (right)

Minimal recognition of rights to organize

Principle 7 argues for minimal recognition of rights, which in our study translates into a certain degree of freedom to use and transform collective gardens.

In case study A, the decision not to build a traditional playground was followed by the initiative of buying toys to be shared by all children. The entire garden became a play area, and toys are now a permanent and itinerant garden decoration. In case study B, there are no individual gardens bordering the collective one. Households were given the opportunity to appropriate part of this collective garden, by placing their own furniture and decor in the open corridor (Figure 7). In both cases, users were granted minimal rights to occupy and transform collective spaces. These actions encourage engagement with the garden and facilitate encounters.



Figure 7. Shared toys in case study A (left); informal gardens in case study B (right)

Nested enterprises

Finally, the last principle addresses the possibility of organizing into several layers of nested enterprises to facilitate successful self-government. We understand that the very garden layout and the act of gardening can be organized in this way. For instance, in case study D, there is a belt formed by a system of wadis and "hills" that embrace and structure the collective space while acting as a boundary for the private realm. This spatial nesting in turn also guides the gardening process.

The gardening of individual spaces is done by the households themselves. But when it comes to hedges between private gardens and the "hills", decisions are made by residents of adjacent houses. The maintenance of wadis is the responsibility of the group of residents who live nearby, while the lawn and green roofs are generally taken care of by larger groups during the garden day. This structuring of the gardening process, facilitated by the garden layout, encourages constant engagement in different levels.

DISCUSSION AND CONCLUSION

This research aimed to identify success factors of the residential garden design as-a-product and as-aprocess in stimulating engagement between people and with the gardens, and thereby contribute to increasing health and well-being of communities. By exploring four case studies situated in the Dutch Randstad metropolis, the results show gardens themselves, especially collective ones, facilitate engagement, as they presuppose interaction, both resident-garden and resident-residents, in terms of use, experience, and maintenance. In addition, garden design can stimulate and even provoke engagement.

Considering garden design as-a-product, we observed some spaces, such as vegetable gardens – and objects – like a playful bench – encourage collaboration. Similarly, the garden layout itself, along with its structuring elements, can motivate engagement; for instance, a central space easily accessed by all residents appears to be more effective than intimate semi-private areas. We also found flexibility is a catalyst for engagement, as it allows multiple uses to accommodate individual expectations within the community.

Considering garden design as-a-process, the results show engagement can be encouraged at different times, whether during or after the design and construction phases. By being involved in any of these moments, residents have the opportunity to engage with the garden and with each other. The design as an ongoing process also seems to successfully stimulate engagement throughout time. And yet, when it comes to long term healthy relationships, the way the community self-governs the garden has a major influence; for instance, bottom-up approaches involving the entire community in decision-making, maintenance, use, and transformation of spaces are more effective than top-down decisions taken by closed committees or housing companies. Furthermore, we understand that a joint analysis of the garden design as-a-product and as-a-process becomes essential as actions to stimulate engagement that happens in one realm reverberate in the other.

Finally, our research confirms collective gardens have great potential to stimulate engagement, which can influence the promotion of healthier and more resilient neighbourhoods in urban areas. However, more studies are needed to truly assess the effects of community engagement in residential gardens at neighborhood and city scale. Similarly, future studies may help to further conceptualize design as-a-process and as-a-product and better understand the relationship between community engagement, health, and well-being. Although the exploratory and comparative case studies approach helped us to identify similarities to point out facilitators of engagement, these ideas are limited to the four studied garden. Thus, expanding the research with more case studies could not only help to identify more success factors and barriers but also to understand and guide the design of residential commons.

NOTES

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ENVISIONING SOUND SENSING TECHNOLOGY FOR ENHANCING URBAN LIVING

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INTRODUCTION

New artificial intelligence (AI) technologies present promising opportunities for improving urban living through environmental sound sensing. AI, broadly speaking, refers to a branch of computer science that creates machines capable of carrying out tasks normally requiring human cognition.¹ Specifically, AI technology for sound sensing is now developing capabilities to automatically categorise everyday sounds to monitor and, in turn, inform new strategies for enhancing quality of life through future urban planning and development.

Accordingly, this technology facilitates an exploration into how context affects how people feel about sounds rather than just their objective loudness. This refers to a "soundscape approach" where desirable sounds in the built environment are emphasised and not masked by unwanted sounds through appropriate interventions such as through associated architectural design.²

Additionally, although human-centred AI, that which is humanistic and ethical as well as technologically advanced, is gaining traction in the USA and UK,³ the development of new AI technologies can lack and overlook appropriate end-user feedback when focused on technological innovation. Even if quantitative metrics, such as classification accuracy (e.g. for types of sounds), indicate a AI system performs well in a lab setting, the system might not be solving the issues of importance for end-users in the field.⁴

Embedding qualitative feedback throughout the development of AI systems is also necessary to reduce disparity between technical performance and responsiveness to real-world problems and user needs. This aligns with a user-centered design approach that involves identifying and employing contextual user needs to direct new design concepts.⁵

Participatory approaches⁶ can be used as part of this approach to enable a variety of stakeholders to engage in and direct research by providing a platform for participants to express their thoughts and feelings about certain concepts. This paper presents initial findings from the "AI for Sound" project where a range of participatory approaches are being employed to direct project outcomes with stakeholders throughout the development of new AI for sound sensing technology.

In this paper we report on initial findings from our user research where we used a tailored participatory approach called a "virtual world café" to explore how Guilford residents felt about the sounds in their locality to direct future technology research for creating new AI for sound sensing technologies. To begin, the concept of user-centered AI is defined and differentiated from other related and established terms "trustworthy" and "explainable" AI. Subsequently, we discuss how user-

centered AI could be applied to AI for sound sensing technologies to improve acoustic environments and how user-centred AI for sound aligns with a soundscape approach. Following this, the significance of participatory research is discussed as well as the way it could be used to develop new user-centered AI. The "world café" as a participatory approach is then introduced with commentary on its suitability for supporting user-centered AI. This sets the context for subsequent sections that sequentially elaborate on the methodology, findings, and conclusions with plans for later research.

DEFINING AND DESIGNING FOR USER-CENTERED AI

The overall aim of this research is to apply a user-centered design approach to AI, specifically new AI for sound sensing technologies, where AI is designed and created for maximum perceived value (such as through responsiveness to need) and usefulness (how well it serves its intended users to achieve their goals in context).⁷ For conciseness of argument, this paper will use "user-centered AI" to refer to this approach.

Although related, user-centered AI is not to be confused with other terms "trustworthy/responsible", or "explainable" AI. For example, trustworthy AI, commonly used interchangeably with responsible AI, is defined as AI technologies that encompass "reliability" (i.e. performs as expected when needed), "safety" (i.e. does not cause human suffering), "security" (i.e. robust against cyber-attack), "privacy" (i.e. safeguards identifiable data), "availability" (i.e. ready when needed) and "usability" (i.e. straightforward to use).⁸ Moreover, explainable AI refers to the ability of AI technologies to provide users with explanations of the system's actions that consider their background knowledge, understanding, and overall contextual goals.⁹

Notably, creating user-centered AI could potentially lead to new AI technologies that are trustworthy/responsible, and explainable as their related characteristics, such as support of privacy and explainable results, are determinants of user-centered AI qualities: value, and usefulness. Now that we have explained user-centered AI, we will now apply this to AI for sound sensing technology.

User-centered AI for sound and soundscapes

We propose exploring how user-centered AI could be applied to AI for sound to improve the acoustic environment. User-centered AI for sound requires us to firstly understand how people feel about sounds in their environment so that we can determine how this technology can be developed for their needs.

Different sounds can lead to positive or negative emotional responses from listeners depending on how the sounds are perceived even if the sound level (i.e. decibel) is not very high.¹⁰ For example, one individual might find the sound of a radio pleasant while working but another could find this annoying. Previous literature has also demonstrated notably patterns in sound types and emotional responses where natural sounds tend to trigger positive emotions (i.e. sense of calm), mechanical sounds can initiate negative emotions (i.e. annoyance) are reactions to human sounds are context dependent.¹¹

Soundscapes are defined by the 2014 ISO 12913-1 standard as "[the] acoustic environment as perceived or experienced and/or understood by a person or people",¹² and can be comprised of fragmented, individual sounds [i.e. "sound events"] and/or contain numerous sounds concurrently [i.e "sound scenes"].¹³ User-centered AI for sound naturally aligns with a soundscape approach by using understandings of how people feel about sounds in particular contexts to direct its technology development.

In fact, AI for sound sensing technology is developing the capability to recognise "sound events" and "sound scenes" that comprise soundscapes and could be created to identify and mask or remove

unwanted sounds and/or amplify pleasant sounds in different contexts to improve listening experiences.

Participatory research for user-centered AI

Participatory research, also known as participatory action research (PAR)¹⁴ emphasises a collaborative relationship between participants and researchers to create collective understandings and diverse perspectives of topics being explored through shared expertise and knowledge. It is part of a user-centered AI approach as it champions the feedback of end-users to determine research outcomes. Example methods for PAR include photovoice (involves the use of participant captured images to convey concepts),¹⁵ digital storytelling,¹⁶ (includes the sharing of short videos made by participants to communicate experiences) and world cafés. The "world café" method guided the creation of a new "virtual world café" method that informed the findings of this paper.

World cafe as participatory approach

World cafés have been employed widely outside of academia to facilitate organisational change such as in large multinational corporations, small non-profits, government offices, community-based organisations, and educational institutions internationally.¹⁷ Recently, more and more researchers have used it as a suitable qualitative research method for involving a wide-ranging sample of participants to foster novel ideas through sharing of knowledge in a relaxed environment.¹⁸ A world café is typically set in a café style surrounding where participants, in small groups (max of five), converse on a question posed in three 20-minute rounds, concluding with a "Harvest Session" where everyone agrees on conclusions from conversations together.¹⁹

The world café is underpinned by several core principles:

1. "setting the context"— the purpose of the meeting is made clear to participants so that the most significant points can be identified and explored²⁰

2. "create hospitable space"—the environment should evoke a safe and secure ambiance to make participants feel comfortable to engage in emerging discussions freely and openly²¹

3. "encourage everyone's contribution"—the host/facilitator creates a context for everyone to contribute equally²²

4. "connect diverse perspectives"—group members switch tables after each round to diversify discussion and widen social circles of thought²³

5. "listen together and notice patterns"—during question rounds only one person speaks at a time while others provide quality listening by not interrupting and paying attention to what the person $says^{24}$

6. "share collective discoveries"—at the end of the question rounds all groups are invited to share insights and conclusions as part of a collective conversation called the "Harvest Session" to locate emerging synergies in knowledge and opportunities for associated action.²⁵

The world café is suitable for gathering and converging a variety of ideas from a large range of participants in a time efficient manner. It was therefore selected as an appropriate participatory approach to inform research directions for the development of user-centered AI for sound sensing technologies.

METHODOLOGY

This study was qualitative in design as it focused on exploring the "lived experience"²⁶ of how residents perceived sounds in their urban environments. It took a PAR approach and applied the world café method with residents living around Guildford, a town in south-east UK.

Due to lockdown restrictions in the UK at the time (spring, 2021) where people were required to stay at home, the world café method was modified to create a "virtual world café" method, allowing the entire study to be conducted remotely. Literature on applying a "virtual world café" method is sparse, with Gilson's²⁷ PhD thesis appearing to be the only research publication to-date that overtly explores a "virtual world café" method.

Gilson's virtual world café mimics the usual format of a physical world café (see "World café as participatory approach section") using a teleconference tool with virtual Breakout Rooms to divide participants into small groups for the discussion rounds.²⁸ Reported limitations of this method included a lack of participant guidance when in Breakout Rooms that lead to some participants dominating conversations and not knowing who to nominate to summarise the group's discussions.²⁹ We now present our "virtual world café" method that builds upon Gilson's method to overcome these issues and advance knowledge in this area.

Method

Prior to the study, participants are emailed the questions for discussion during the virtual world café to reflect on beforehand as well as guidelines for participation, such as no interrupting others and listening to what each person says. Participants are also invited to an informal and optional virtual training session on the video conference tool to be used.

Our virtual world café method consists of an introductory presentation, three Breakout Room Sessions, three Mini-Harvest Sessions, and one Harvest Session, following the format and timings in Figure 1 below:



Figure 1. Structure and timings of virtual world cafe.

For the Breakout Room Session, participants are put into small groups of no more than five and divided between up to four designated virtual Breakout Rooms, each focusing on discussing results from one of the preparatory questions. Each Breakout Room has a Table Chair (a previously nominated participant) who invites different participants to speak during Breakout Room Sessions, keeping everyone to time, and a Scribe, a project representative, who takes summary notes of discussions.

Each Breakout Room Session is succeeded by a Mini-Harvest Session where everyone re-joins the main room, and the Scribes share the highlights from their Breakout Room discussions. The event concludes with the Harvest Session where the Table Chair for each Breakout Room summarises themes from the three Breakout Room Sessions and a general discussion is had between everyone on overall insights.

The questions for discussion were as follows:

Q1. What sounds can you hear in your locality either directly outside your home, or somewhere you visit for daily exercise and what sounds do you find annoying or pleasant and why?

Q2. What would be your ideal soundscape here?

Q3. What imaginary new technology that would allow you to achieve this?

All conversations during the virtual world cafe were audio/video recorded by the video conference tool Zoom and automatically transcribed by its "Audio Transcription" feature. Fieldnotes of emerging discussions were also created throughout the virtual world café sessions by the Scribes.

Data analysis

Data collected was analysed using grounded theory³⁰ through open, axial, and selective coding, and reflective memoing.³¹ All audio/video content of discussions transcribed was initially analysed using opening coding to locate themes and properties/codes. Axial coding was then employed to locate connections between arising themes and their proprieties. Finally, selective coding was used to finalise emerging themes and their relationship to research questions (i.e. what types of sounds could be monitored to have a positive impact on the sonic environment of urban areas?). Fieldnotes and memos were compared against the themes generated from analysis of transcripts to help finalise emerging research themes.

Sampling

12 Guildford residents, aged between 24 and 60+, were recruited for this study by advertising a callfor-participation to a variety of social media groups, such as the Guildford Society (a charity group that protects local heritage sites), with the criteria:

- Adult (over 18 years of age)
- Living within 10 miles of Guildford
- Have an interest in improving the acoustic environment
- Have access to an internet connected and video and microphone enabled computer, laptop, tablet, or smartphone

FINDINGS

Through review of themes and properties emerging from transcribed discussions, two novel concepts emerged:

- objectively noticeability-the hearable decibel level of sounds
- subjective noticeability—the emotional response to sounds that are objectively noticeable

Subjective noticeability could cause a negative, neutral, or positive emotional responses from the individual. Significant sounds that were discussed as having positive, neutral, and negative subjective noticeability as well as variables for this are described in the following subsections.

Positive, neutral, and negative subjective noticeability

In terms of positive subjective noticeability, participants found natural sounds, such as bird song, very pleasant, as well as human sounds that evoked a sense of community. For example, one participant commented "I do just like to hear soothing, yeah natural noises that just... that kind of fade into the background but fundamentally the effect they're having on me is quite just a relaxing effect..." while another participant remarked, "Sometimes I hear people talking and laughing... it reminds me I'm part of the community".

In relation to neutral subjective noticeability, sounds that provided practical information about what is happening in the surrounding environment were generally perceived neutrally. For instance, one participant mentioned, "There are also other noises that are absolutely critical for life, safety, we talked about ambulances and police cars and fire stations, but it's really important that you do hear those".

Lastly, negative subjective noticeability mainly included mechanical sounds (i.e. heavy machinery) and out-of-place human sounds (i.e. aggressive shouting). For example, one participant stated, "occasionally we have some building work near us... drills and diggers... some of the builders will swear or sound angry and aggressive or loud... the tone they use is an unpleasant sound". These findings support previous soundscape literature where natural sounds lead to positive emotions (i.e. feeling of calm), mechanical sounds can lead to negative emotions (i.e. annoyance), and responses to human sounds are situation dependant (i.e. disruptive vs complementary to context).³²

Variables for subjective noticeability

Through analysis of participant discussions, variables for subjective noticeability being perceived as either positive, neutral, or negative included:

- control (over sounds)
- duration
- repetition
- history (i.e. memories associated with certain sounds)
- personality traits (i.e. sensitivity to certain sounds)
- objective noticeability
- information provision (i.e. such as what exists in one's environment)
- current activity (i.e. relaxing vs working)
- personal situation (i.e. living alone vs living with others)
- personal values" (i.e. dislike of traffic sounds as associated with unsustainability)
- public vs private space (i.e. individuals were more forgiving of sounds in public spaces as they could move away from them)

Notably, having control or the impression of this could override the other variables that cause negative noticeability, regardless of sound type (i.e. natural, mechanical, human), or context. New AI for sound sensing technologies could therefore potentially give direct control, or a sense of control over the sounds in residents' immediate environment to improve quality of life in urban living.

Research directions for AI for sound sensing

When describing ideal soundscapes (see Q2.), participants unanimously wished for less unwanted sounds, such as from loud traffic, home appliances and heavy machinery, interfering with their enjoyment of surrounding natural sounds through better government regulation and communication with neighbours.

All participants agreed that future technology (see Q3.) should enable a reduction and confinement of essential mechanical noise, or at least provide residents with warning and justification for the existence of such noise. Participants also suggested new technology for personal use that could mask or remove unwanted sounds, or enhance pleasant sounds (e.g. bird song) that was cost effective, and unnoticeable (i.e. wearable, mobile).

Ideal AI for sound sensing technologies would therefore include personal unnoticeable devices for recognising and then removing or masking unwanted sounds in the home, tailored to specific activities (i.e. sleeping, working). In public and residential areas, ideal AI sound sensing technology might be deployed as a network to classify emerging sounds with subjective feedback from residents that could inform future government regulation on urban planning, development, and building work.

Although we don't currently know the feasibility of these technologies, we now understand the needs that underpin them, such as the need to reduce mechanical noise in residential areas, to inform future research.

CONCLUSION AND NEXT STEPS

We found that the virtual world café provided participants with a suitable platform to express their thoughts on how new AI for sound technologies could improve the sounds around them. It offers an appropriate means of engaging a large range of participants with online access, especially under the ever-changing constraints of the COVID-19 pandemic.

Overall, the most promising findings suggested that AI for sound technologies could be used in public spaces to regulate mechanical noise, increasing enjoyment of surrounding pleasant sounds—such as bird song.

The next steps for this research will therefore involve using these findings to develop prototypes of sound sensors in partnership with relevant SMEs and local authorities, to be subsequently tested and refined using additional participatory approaches with appropriate stakeholders and end-users.

To explore the virtual world cafe method further in other contexts, this method will be employed to explore AI for sound technologies for workplace wellbeing with a range of employees around London and Guilford.

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A SALUTOGENIC APPROACH TO AGE FRIENDLY HIGH STREETS

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INTRODUCTION

Meeting the challenges of an ageing population has generated debate on the types of supportive environments needed to enable older adults to retain a sense of independence and well-being in their everyday life. Ageing-in-place policies have recognized the need to go beyond achieving a close fit between housing characteristics and personal needs. For many older people it is the chance to be connected to the community and participate in local civic and social life, this entails the use of a variety of urban settings, including the main commercial streets, the so-called high streets. Despite their perceived decline they are a prominent feature of the everyday environment in which many people grow old and continue to cater for the everyday needs of a wide sector of the population providing access to shops and services at local level. Yet, there has been little attempt to articulate this within the everyday lives of older adults and as a result, we have limited understanding of how these locales can be designed to better support older people. In the design of the public urban realm older people have been usually considered a vulnerable group and their needs frequently narrowed to issues of physical mobility. In addressing this gap, this paper describes the findings of empirical research based on three case studies in Edinburgh and it explores the salutogenic - health and well-being supportive - potential of these locales for an ageing population.

AGEING IN PLACE AND THE LOCAL HIGH STREETS

Older people have been seldom mentioned in urban design literature until the launch of the World Health Organisation (WHO) Age-friendly cities programme¹ when more references to age-friendly environments began to appear. In general, urban designers have been reluctant to engage with the topic of ageing² and in the design of the public urban realm older people have been usually considered a vulnerable group and their needs frequently narrowed to issues of physical mobility³. Yet, due to the population ageing this demographic sector is no longer a minority, 'Older people [are] everywhere' was Christopher Alexander premonitory claim in the late 1970s in his pattern no. 40^4 . This demographic sector is about 17% in UK⁵ and projected to grow in the coming decades^{6,7}. Older people are, and gradually will be everywhere. With specialised housing falling short of a growing demand, people not only prefer to age in their own place, but likely this will be their only viable option. As a public policy 'ageing in place' aims at fostering healthy ageing - adding years to life - promoting suitable domestic environments, and keeping people connected to the places and the community they know best. Within this everyday environment local high streets are a prominent feature.

High streets have historically supported a great portion of urban activity due to their "dual function as 'links' in a movement system that connects places and as destinations, or 'places', in their own right"⁸. They functioned as channels of movement and communication, providing the "infrastructure" for everyday activities and related housing opportunities offering convenient access to amenities and services and can be a focal point for community and social interaction and participation⁹. They have been described as "the public space through which a significant proportion of Britain's sizeable urban population are able to access a range of consumer, commercial and community services", and particularly those "disadvantaged members of the society" with lower income and restricted mobility, such as the elderly among others¹⁰. Specific mention to an ageing population in the literature and reports on the regeneration of UK high streets is sparse with reference to issues of mobility and access¹¹¹². Reference has been also made to the needs of all age groups¹³ supporting interaction between generations¹⁴ and appealing to "younger and older people"¹⁵.

The traditional emphasis on shops and trade makes UK high streets victims of a market led urbanism which proves unable to accommodate swift changes in consumers' behaviour and fails to find suitable alternatives to keep them vibrant places of exchange¹⁶. The Royal Institute of British Architects (RIBA) 'Sliver Linings' report¹⁷ suggested that "the British High Street in 2030" and an active Third Age could be mutually "invigorated". The former becoming attractive to a wider population as liveable hubs of social and economic activity, the latter improving their well-being and health. As such, the RIBA scenario seems to be situating the high street within the "healthy settings" framework advocated by the Ottawa Charter for Health Promotion¹⁸ which, being influenced by medical sociologist Aaron Antonovsky's salutogenesis theory, put everyday environment at the core of health and well-being creation. By studying concentration camps survivors that managed to thrive in the post-war, Antonovsky questioned the prevalent idea that equated health with the absence of disease and tension and acknowledged that our condition is an incessant movement along an ease/disease continuum. Salutogenesis was for him the movement towards the health and well-being end of this scale, achieved by managing resources through a general disposition to life - the Sense of Coherence (SOC)^{19,20}. Resources, Antonovsky reminded us, can be both internal – physical and psychological – and external – such as for example the social network, and the places in which one lives, which in UK may include the public realm of local high street.

This paper moves away from functional ecological models of ageing²¹, and looks at the relational aspects of well-being and place^{22,23}, considering how salutogenesis theory provides a theoretical link between the analysis of specific settings and older people self-reported well-being. The three components of SOC, namely comprehensibility, manageability, and meaningfulness, echo similar concepts in urban design, and suggest a link between urbanism and the subjective experience of ageing in place. The RIBA 'Silver Linings' report is speculative in nature, and little tells us how these places are currently used and what people's experiences are. To understand to what extent local high streets can be considered salutogenic settings supporting ageing in place empirical research was undertaken on local high streets. The following sections of the paper describe the methodology used in the research and then discuss the findings in relation to SOC main categories and cognate urban design concepts.

METHODOLOGY

This section introduces the research design and the methods used to collect and analyse the data.

Place-based cases studies

An in-depth, inductive place-based investigation was undertaken to explore older adults' well-being, defined in this paper as in other people-environment studies^{24,25} as the self-reported subjective assessment of what people describe as having a positive impact on their daily life experiences. A purposive sampling strategy was adopted and 84 participants ranging between 63 and 96 years old were recruited in the local communities around three local high streets - also referred to as 'local town centres'^{26 -} in the city of Edinburgh, Scotland. These locales - Corstorphine town centre (CTC) in the west, Leith Central town centre (LTC) in the north-east and Morningside town centre (MTC) in the south - were chosen to capture a wide spectrum of social, economic, and urban variables as illustrated in Figure 1.



Figure 1. Three Edinburgh local high streets chosen as case studies.

Data collection and analysis

A range of interviews were chosen as the primary method of data collection to access place meanings and behaviours from the perspective of older people. Walking interviews (n=25), along an itinerary of participants' choice, were prioritised to place the narrative of participants' experience in its spatial context, allowing for a greater understanding of the interaction with the built environment and for situated social encounters to be observed and recorded^{27,28,29}. Semi-structured interviews (n=16) were used to achieve an in-depth discussion about perceptions, feelings and life course events, and twelve focus groups (n=51, 3-8 participants) were undertaken amongst community groups around already scheduled activities providing an opportunity to develop more collective understandings of place. Interviews' recordings were transcribed verbatim and the data was analysed following a "thematic analysis" approach³⁰ developing a framework aiming to identify well-being related resources – from features of the physical environment to social settings and activities.

RESULTS AND DISCUSSION

Four main dimensions of well-being that the socio-spatial realm of local high streets afford emerged from the research, namely: social interactions, from meeting friends to passive sociability; a general sense of attachment and belonging nurtured by the re-enactment of memories; the pleasure derived from feeling out of home and active; and a sense of mastery and autonomy in pursuing activities of daily life. These dimensions are below discussed in relation to SOC categories and in doing so the

links between salutogenesis theory and key features of the high streets public realm that were reported beneficial for older people's well-being are highlighted.

Comprehensibility

Antonovsky conceived comprehensibility as "the extent to which one perceives the stimuli that confront one, deriving from internal and external environments, as making cognitive sense, as information that is ordered, consistent, structured and clear"³¹. For many older people local high streets can be considered as comprehensible and distinctive places within a landscape of everyday urban settings. Comprehensibility turned to be sustained by the social and quasi-parochial³² dimension of local high streets.

Comprehensible high street features

Interviewees referred to "familiar faces", including shopkeepers and sale assistants as "categorically known others"³³, even if the quicker turnover of shops and businesses may unbalance their dependability in the longer run. As spatial cognition comprehensibility is relevant to read a place as distinctive, and to move around easily. Conversely, a comprehensible environment is the one with a strong imageability and legibility³⁴, which can facilitate wayfinding. In local high streets the main contributing factor to comprehensibility proved to be the variety of small shops in active frontages. Small outlets make the place more attractive, offering a "stimuli" that in a virtuous circle, triggers interest, prompts older people to leave home and fosters their mastery of the place.

Manageability

Manageability is according to Antonovsky how "one perceives that resources are at one's disposal which are adequate to meet demands posed by stimuli that bombard one"³⁵. It is related to the experience of stress and the correspondent capacity to cope; to the perception of one's own capacity of being influential in shaping the environment; and to the availability of resources and the ability to make use of them.



Figure 2. Managing daily errands.

Local high street as manageable everyday setting

Participants considered local high streets manageable when the streetscape is sufficiently accessible, and they feel secure to go around. Whilst some reported the need for improvement to the streetscape – particularly in relation to the width and quality of pavements - they generally found the three case studies offering the right balance of vibrancy in terms of people and traffic, as opposed to the city centre which is considered overloading. In the literal sense, manageability also means being empowered to make decisions about the place and can be related to the political dimension and decision-making process concerning the spatial milieu of the local high streets. Public engagement in these locales was usually limited to statutory planning consultations and a greater sense of ownership emerged only when a local community centre run by volunteers moved within premises on the same high street. The combination of public café', charity shop, children soft-play area, and a range of spaces available for daily activities proved to be very successful, ultimately prompting group of elderly to engage with the consultations about the redevelopment of the block. We can also think of manageability as the ability to make use of available services and facilities. They may well be available along the street, however, when physical and cognitive faculties are on the wane it is their spatial distribution that matters most. The clustering of amenities at reasonable walking distance from bus stops can make the offer more manageable and therefore truly supportive for everyday errands and activities. Finally, the perceived "convenience" of local high street is not limited to access to shops. It also entails an appraisal of potential social encounters, which encourage everyday use of their public realm accruing to the meaning of the place.

Meaningfulness

Meaningfulness is, for Antonovsky, the most important component of the SOC. "It refers to the extent to which one feels that life make sense emotionally, that at least some of the problems and demands posed by living are worth investing energy in, are worthy of commitment and engagement, are challenges that are welcome rather than burdens that one would much rather do without"³⁶. Antonovsky refers here both to the general understanding and self-confidence in everyday life, and also to the expectations of emotional rewards that life experiences may provide.



Figure 3. A meaningful public realm.

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Meaningful local high street for ageing well.

In this study local high streets are meaningful to the extend they motivate people to "go out and about" welcoming the demands posed by the environment and being receptive to the emotional rewards that the everyday use and the aesthetic experience – the atmosphere³⁷ - of these streets provides. Local high streets have been - and for many older people still are - urban repository of affects and memories that underpin attachment and identification with the place in which they are ageing. However, one single dimension of everyday use of these locales emerged above all others: the opportunities of social interaction they afford.

Antonovsky always stressed the relevance of the impact of society and social conditions on people health and well-being. The responsibility in moving to the health end of the "ease/dis-ease continuum" is not one's personal choice, for Antonovsky it resides in the interplay of the individual and society and as such is very much a collective endeavour. Social life can contribute to meaningfulness of life, and not surprisingly for many older people, with a shrinking social circle and frequently living alone, errands and other activities are often a pretext to get out from home to meet people at a local high street. From the feeling of connection when surrounded by other people in local cafes, to fleeting encounters with the aforementioned 'categorically known others'³⁸ in shops and supermarkets, or to arranged meetings with friends and acquaintances, meaningfulness in local high street is to be found in a variety of forms and spaces. Comprehensible and manageable local high streets can let an ageing population harness better the opportunities of social interaction these locales afford, making them meaningful, and therefore relevant for a positive movement towards the healthy end of Antonovsky's continuum in later life. Figure 2 below summarise the key well-being supportive features of high streets hitherto discussed in relation to the three categories of the SOC.



Figure 4. The three dimensions of the salutogenic high street.

CONCLUSION

The Edinburgh case studies considered in this research are a positive demonstration of commercially active local high streets that afford access to services, amenities, and social interaction in a variety of forms. They are relevant places for the people ageing within the community and a quintessential source of everyday well-being. However, the decline of many similar places across the UK, demonstrate that their relative success cannot be taken for granted. Social historian Peter Laslett pointed out³⁹ that the demographic change will be faster than we are aware of - older people will be

everywhere soon - and the current laissez-faire approach is not likely to deliver the RIBA 'invigorated' UK high streets scenario⁴⁰ to support this growing demographic sector. The COVID-19 pandemic seemed to provide an opportunity to improve the streetscape of several high streets in Edinburgh. The local council promoted the so called "Space for People"⁴¹ plan and in 2020 introduced temporary traffic regulation orders (TTROs)⁴² to help physically distance and improve pedestrian and cycling access to local shops and services. This resulted in wider pathways providing more space for pedestrians to move around particularly at certain pinch points as shown in Figure 5.



Figure 5. Provisional "spaces for people" measures in local high street.

Albeit provisional in character, not resolving in full the existing accessibility shortcomings these measures responded to some of the findings of this research increasing the space available for pedestrian. Following a public consultation in 2022 though, most residents and business⁴³ supported the removal of all measures in local high streets. It remains to see if the consultation reached out to older people as the only available breakdown by age is the one reported on the market research⁴⁴.

Never mind what seems for the time being a provisional response – the TTROs - to a critical situation – the pandemic, what this research has shown is that local high streets have the potential to support the well-being of those growing old, if only we aim to re-design these streets as comprehensible, manageable and meaningful places.

NOTES

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IMPACT OF LIVING ENVIRONMENT ON SOCIAL RELATIONSHIPS OF OLDER PEOPLE WITH DEMENTIA IN CARE AND ATTENTION HOMES

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INTRODUCTION

Dementia, as a serious cognitive disorder, is a serious chronic health problem threatening older people (Ernst and Hay, 1994). ¹ Nowadays, approximately 55 million people worldwide suffer from dementia, which has ranked as the seventh leading cause of death.² In Hong Kong, the population has increased significantly in the past forty years from 5.2 million in 1981 to 7.5 million in 2020, and it is expected to be further increased to 8.4 million in 2033. ³ Hong Kong people are enjoying a long life expectancy. The average life expectancy in Hong Kong is 83 years and 88 years for male and female respectively, which have caused Hong Kong society to face serious aging problems. In 2011, around 13.3% of the total population (1.3 million) in Hong Kong aged 65 and above, while this proportion increased to 19.1% (1.4 million) in 2021 and is expected to be increased to 28.5% (2.3 million) in 2033.⁴

The older people with dementia often suffer more from emotional disorders (e.g., depression and hallucinations), cognitive impairment (e.g., memory loss, spatial/time disorientation), and dysfunctional behavioral patterns (e.g., wandering and yelling) than normal older people.⁵ Thus, people with dementia and its associated symptoms may have different needs in terms of the living environment (LE) in their daily life.

In Hong Kong, there are two domains of care services: community support services and residential care services. Residential care services include elderly hostel, home for the aged, care and attention home (C&A home), and nursing home. People getting old with limited ability can move to the home for the aged or C&A home, but they still can move around in/out of the homes with a certain degree of autonomy. Those who mainly rely on the services need to stay in the nursing home with full support. ⁶ Over 26,300 places are offered in the C&A homes to accommodate elders in Hong Kong, while approximately half of the homes have older people with dementia. ⁷ In fact, the quality of services varies greatly. For example, some homes accommodate 5-6 residents living together in a 20 m² sleeping area with low-level partitions. ⁸ However, the homes usually can meet the current basic requirements stated in the Code of Practice for Residential Care Homes (Elderly Persons) in Hong Kong. Out of 16 sets of Service Quality Standards applied by the government, only one considers the safety of the physical environment of care homes. ⁹ Apart from making available meals and beds, C&A homes should also consider an appropriate LE to maintain the quality of life of older people, including physical and psychological health as well as social relationships. Thus, this study aims to

investigate the impact of LE for older people with dementia living in C&A homes on their complicated social relationships.

SOCIAL RELATIONSHIP

Referring to the World Health Organization (WHO), the social relationship includes companionship, social support, reciprocity and feeling useful. Older residents in C&A Homes have had to deal with retirement, social roles and declining health, and their social networks have shrunk as a result, especially peripheral members.¹⁰ Providing the sense of connectedness, safety and security, both intimate and peripheral relationships are necessary for the quality of life of older people.¹¹ Therefore, companionship is important to maintain intimate and peripheral relationships.

Given by the support network members, social support can be emotional, instrumental, informational or appraisal. It contributes to the meaning of life, and may help the independence of older people.¹² Hence, social support may be a major source of personal care and well-being for older people.¹³ Older people getting help from their family members or friends may also enhance their sense of meaning.¹⁴ Moreover, supporting from children is also related to higher well-being and less cognitive impairment, particularly for those without a spouse.¹⁵

Reciprocity means not just receiving but also being able to help others as well as giving friendship. Older people often feel less independent and meaningless when receiving support. However, they may feel independent, involvement, meaningful and useful when giving their support.¹⁶¹⁷ Reciprocity can contribute to satisfaction with life, ¹⁸ and help to cultivate a secure style of attachment.¹⁹

LIVING ENVIRONMENT

Extensive literature has pointed out that the LE may have impacts on the social relationship.²⁰ LE in C&A home consists of three major components: architecture, building services and supporting facilities.²¹²² Architecture includes items involve public and private areas, distance between the rooms, privacy, finishes, color, and decoration. The distance between the rooms and the privacy of bedroom and living room may affect the social pattern of older people.²³ Bedroom close to the living room may induce noise and disturb the rest and sleep of older people. Too far away between bedroom and other activities space may create inconvenience and may prevent older people with dementia from their bedrooms to the social activities.²⁴ On the other hand, the patterns and the glare on the finishes ²⁵²⁶ may confuse older people with dementia.

Building services include artificial lighting and daylighting as well as the temperature in different rooms. Too dim artificial lighting may cause older people to lose sight of obstacles during walking and be trapped over there, while the frequencies and flickering of the compact fluorescent lamp may induce headaches and eye fatigue.²⁷ All-night exposure to bright light in the evening may also cause a bad effect on mood.²⁸ At the same time, the color of artificial lighting may affect the sleep and emotion of older people with dementia particularly.²⁹ It is expected that natural light can regulate the circadian rhythm of older people and may reduce depression.³⁰ When the temperature is too low, the death rate of older people increases.³¹

The supporting facilities refer to furniture arrangement, handrails, and signage, digital and game materials for social activities. A proper furniture arrangement may support the memory of older people.³² As some older people with dementia like to wander around the homes, handrails are very important for the mobility of older people. The appropriate height and shape of the handrails can facilitate them to grasp the rails firmly, ³³ and digital materials and games may stimulate the mind, thereby enhancing their cognitive abilities. ³⁴ Besides, leisure activities may help older people connect with others. ³⁵

RESEARCH MODEL

To explain the relationship between the LE in C&A home and the social relationship of the older people with dementia, a conceptual LE-Social Relationship model has been built (see Figure 1). Based on the extensive literature, it is hypothesized that the three components (architecture, building services and supporting facilities) of LE items have a significant relationship with the social relationship, which includes companionship, social support, reciprocity and feeling useful of older people with dementia.



Figure 1. Conceptual LE-Social Relationship Model for Older People with Dementia in C&A Homes.

METHODOLOGY

To investigate the hypothetical relationships shown in the model, a questionnaire survey was designed and distributed to older people with dementia in C&A homes. The questionnaire consists of the background, the social relationships for the older people with dementia, ³⁶ and the satisfaction of living environment in the C&A homes. ³⁷ A five-point Likert scale with 1 (never /extremely dissatisfied) to 5 (always /extremely satisfied) was applied in the LE and social relationship sections.

All the participants were aged 60 and above and had already lived in the home for more than 3 months. Before conducting the questionnaire survey, older people were required to complete a qualitative test of Mini-Mental State Exam (MMSE) in Chinese. Only individuals with mild to moderate dementia scoring 13-24 in the MMSE test were invited to join this study. The survey was conducted face to face. Ninety-six responders were valid for data analysis.

Various statistical techniques, including mean, correlation analysis and regression analysis were adopted for the data analysis. Pearson correlation analysis was carried out to evaluate the pair relationships between two items of LE and social relationship, while regression analysis was adopted to further explore the relationship. The items confirmed by both correlation and regression analyses were used to develop the LE-social relationship model.

RESULTS

Correlation Analysis

The results of correlation showed that four social relationship items are basically related to each other, but privacy in bedroom (E3) and game materials (E24) have no significant relationship with social relationship items. Temperature (E5 & E6), lighting (E7-E9), finishes (E16-E18) and signage (E19-E22) are significantly related to most of the items of social relationship, while the distance (E1-E2), areas (E4), furniture (E10-E12), handrails (E13-E14), and digital materials (E23) are related to one or two items of social relationship.
Items	S1	S2	S3	S4
S1 - Companionship	1.000			
S2 - Social support	125	1.000		
S3 - Reciprocity	.365**	256*	1.000	
S4 - Feeling useful	.218*	503**	.584**	1.00
E1 - Distance between bedroom and living room	.169	240*	.188	.202*
E2 - Distance between bedroom and dining room	.279**	047	.165	.276**
E3 - Privacy in bedroom	.170	003	074	047
E4 - Division of public and private area	.125	240*	.072	.287**
E5 - Temperature in bedroom	.329**	205*	.162	.299**
E6 - Temperature in living room	.362**	047	.202*	.281**
E7 - Level of daylighting	.251*	.148	.206*	.039
E8 - Level of artificial lighting at daytime	.327**	268**	.365**	.313**
E9 - Level of artificial lighting at night	.234*	266**	.204*	.323**
E10 - Furniture arrangement in bedroom	.294**	111	.116	.278**
E11 - Furniture arrangement in living room	.307**	013	.131	.236*
E12 - Furniture arrangement in dining room	.420**	196	.181	.172
E13 - Number of handrails	.042	261*	.191	.403**
E14 - Location of handrails	.067	248*	.186	.377**
E15 - Color contrast between finishes of different rooms	.263**	187	.228*	.427**
E16 - Finishes patterns	.250*	248*	.401**	.543**
E17 - Provision of tactile stimulation in finishes	.297**	364**	.359**	.542**
E18 - Provision of personalized decoration	.304**	155	.237*	.342**
E19 - Glare-free settings (e.g., finishing surface)	.444**	120	.363**	.390**
E29 - Number of signage	.139	305**	.256*	.456**
E21 - Size and readability of signage	.259*	249*	.049	.375**
E22 - Color contrast of signage with surrounding environment	.272**	391**	.295**	.605**
E23 - Provision of digital materials	015	234*	065	.135
E24 - Provision of game materials	.110	.128	072	113

Table 1. Correlation between LE and Social Relationships of Older People with Dementia.Note: ** Correlation significant at the 0.01 level (2-tailed).

* Correlation significant at the 0.05 level (2-tailed).

Regression Analysis

Four regression models were built based on the four social relationship items. The models indicated that digital materials (E23), game materials (E24), privacy (E3), furniture (E10-E12), distance (E1-E2), handrails (E13-E14), and areas (E4) have no relationship with the social relationship. In Model 1, glare-free settings (E19), size and readability of signage (E21) and level of artificial lighting at daytime (E8) could significantly predict the companionship (S1), accounting for 32.2% of the variance. Model 2 shows that the social support was negatively predicted by the color contrast of signage with the surrounding environment (E22) and the tactile stimulation in finishes (E17), explaining 26.6% of the variance. With 31.4% variance, reciprocity (S3) could be influenced by finishes patterns (E16), level of daylighting (E7) and level of artificial lighting at daytime (E8) in Model 3. In Model 4, it was shown that feeling useful was positively predicted by color contrast of signage with the surrounding environment (E22), tactile stimulation in finishes (E17), and temperature in living room (E6) with a variance of 54.5%.

Models		Р	B S.E.	Sig.	VIF	R	R²	ANOVA	
		В						F	Sig.
1	Companionship	←		Living	Living Environment				
	Constant	774	.710	.279		.567	.322	13.754	.000
	E19 - Glare-free settings (e.g., finishing surface)	.506	.120	.000	1.065				
	E21 - Size and readability of signage	.305	.124	.016	1.046				
	E8 - Level of artificial lighting at daytime	.311	.134	.022	1.072				
2	Social support	←		Living	Environ	ment			
	Constant	6.358	.602	.000		.516	.266	15.926	.000
	E22 - Color contrast of signage with surrounding	564	.155	.000	1.175				
	environment								
	E17 - Provision of tactile stimulation in finishes	389	.150	.011	1.175				
3	Reciprocity	←		Living Environment					
	Constant	260	.620	.675		.560	.314	13.273	.000
	E16 - Finishes patterns	.370	.107	.001	1.059				
	E7 - Level of daylighting	.302	.113	.009	1.134				
	E8 - Level of artificial lighting at daytime	.312	.128	.017	1.142				
4	Feeling useful			Living	Living Environment				
	Constant	.100	.565	.860		.739	.545	25.802	.000
	E22 - Color contrast of signage with surrounding environment	.525	.089	.000	1.271				
	E17 - Provision of tactile stimulation in finishes	.331	.086	.000	1.264				
	E3 - Privacy in bedroom	219	.080	.007	1.089				
	E6 - Temperature in living room	.305	.145	.038	1.251				

Table 2. Regression between LE and Social Relationships of Older People with Dementia.Note: S.E. = standard error; Sig. = significance; VIF = variance inflation factor.

Model Establishment

To reliably reveal the complicated relationships between the LE and the social relations of older people with dementia, a LE-social relationship model was established based on the correlation and regression analysis (see Figure 2). The model showed that temperature in living room (E6), daylighting (E7), artificial lighting at daytime (E8), finishes patterns (E16), tactile stimulation in finishes (E17), glare-free settings (E19), size and readability of signage (E21) and color contrast of signage with the surrounding environment (E22) are all significantly related to the social relationship of older people with dementia.



Figure 2. A LE-Social Relationship Model for Older People with Dementia in C&A Homes.
Note: → significant positive relationship confirmed by both correlation and regression analyses;
- → significant negative relationship confirmed by both correlation and regression analyses.

DISCUSSION

The temperature in the living room (E6) is significantly related to the feeling useful (S4). With age, older people gradually lose their ability to regulate their body temperature, ³⁸ while the risk of temperature-related death among people with dementia increases in extremely hot and cold weather.³⁹ Hence, managers and caregivers in C&A homes have to maintain the temperature regularly in order to achieve their preceptive usefulness.

The models showed that the size and color contrast of *signage* (E21, E22) had a significant impact on companionship (S1), social support (S2) and feeling useful (S4). Signage has long been recognized as an essential element for older people, particularly those with dementia, to identify their location and facilitate their wayfinding, ⁴⁰ though it was rated with less satisfaction in the previous study. ⁴¹ To accommodate older people's poor cognitive functioning, signage has to be designed clearly and readably in order to support their wayfinding easily. ⁴² Otherwise, hard-to-find routes prevent older people with dementia from communicating with others or returning to their rooms and feeling frustrated or useless. ⁴³

Both nature *lighting* (E7) and artificial lighting (E8) play important roles in the companionship (S1) and reciprocity (S3) models for the older residents with dementia. In fact, most of older people suffer from aging eye issues and eye diseases like Cataracts and Glaucoma, ⁴⁴ while residents with dementia further suffer from cognitive issues in the daily life. ⁴⁵ Proper lighting can support them to identify the orientation for meeting with friends and families and/or move around to help others in the homes, so that their companionship and reciprocity can be developed. ⁴⁶

In terms of the *finishes*, all the finishes patterns (E16), tactile stimulation in finishes (E17) and glarefree settings (E19) positively affect the social relationship. Specific finishes in different rooms represent specific functional areas, which definitely facilitate older people with dementia to find their destination easily. ⁴⁷ Moreover, less color contrast creates a comfortable, friendly and relaxed indoor built environment, ⁴⁸ hence, it can enhance their memory and orientation of location. On the other hand, an environment with less color contrast minimizes the confusion of older people with dementia, which encourages them to go out to the public areas and participate in social activities. Therefore, the finish is one of the important LE components for developing social relationships among older people with dementia.

Out of five items, four LE items in the model, including signage, lighting, and finishes, are related to the visioning of older people with dementia. Therefore, visioning is playing an essential role for older people with dementia. Although caregivers normally consider games for older people with dementia alleviating their cognitive issues, ⁴⁹ it is interesting to find that there is no significant relationship between game materials (E23 and 24) and social relationship and games cannot support their social relationships. Perhaps, we need to consider interactive elements in the games for older people with dementia.

RECOMMENDATION

According to the LE-social relationship model, some practical recommendations are proposed to improve the social relationship of older people with dementia in C&A homes. To help older people with dementia make sense of their environment, sufficient lighting should be offered to them at high levels in C&A homes. A common symptom of older people with dementia is dislocation of diurnal rhythms, so sufficient daylight is recommended for regulating the body clocks of older people with dementia and, consequently, improving their social relationships. ⁵⁰ To maintain temperature comfortability, air conditioning, fans, warmers, etc. are important, particularly in the winter or summer. At the same time, signage with iconic information, such as graphics and animated signage must be adopted instead of unmemorable numbers and complex words that are hard to identify by the older people with dementia.⁵¹ Finishes with different colors in different rooms could minimize the confusion in identifying different rooms. Besides, non-reflective finishes can reduce glare. Tactile stimulation in finishes can help the older people with dementia who have severe sight impairment to identify their location, particularly in public areas. Satisfactory finishing patterns and personalized decoration for the older people with dementia can enhance their memory of specific rooms.

In this study, 96 older people with dementia were engaged, which is a relatively small sample. However, samples are selected from 8 different C&A homes in a different location in Hong Kong representing sufficient samples in Hong Kong. Thus, this study covers various LE conditions of C&A homes in Hong Kong. A quantitative survey was used to establish the LE-social relationship model for older people with dementia in C&A homes. Lighting, temperature, signage and finishes were found having a relationship with the social relations of older people. However, it was hard to show the complex causal relationship between LE and social relationship with a quantitative survey. An experimental study is suggested to further explore the causal relationships between the identified LE components (lighting, temperature, signage, finishes) and the social relationships.

CONCLUSION

Many older residents in C&A homes are suffering from dementia. The social relationship of the older people with dementia can be impacted by the LE. This study, thus, investigated the impact of LE on the social relationships of older people with dementia. The results revealed that temperature in the living room, size and color contrast of signages, natural and artificial lighting, and finishes significantly influenced the social relationships of older people with dementia in C&A homes. A number of recommendations had been suggested to the designers and caregivers of C&A homes.

High-level lighting in the rooms with sensors automatically adjustment, air conditioning, fans and heaters should be provided in homes. Large signage with clear contrast color and icon, different finishes with glare-free and tactile stimulation in different rooms has also been suggested. Lighting, temperature, signage and finishes should be further studied in the future.

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THE NATURE OF HEALTHY SPACES: BIOPHILIC AND BIOMIMETIC INSPIRED PROJECTS TO PROMOTE QUALITY OF LIFE

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INTRODUCTION

During its evolutionary trajectory, humanity took on a domain and control posture over nature. This can be verified in the multiple complex systems that guide our activities and in the infinity of ephemeral artifacts that permeate and structure our spaces and relationships. These aspects, resulting from human production, as they are organized, impact and aggravate the global ecological crisis.¹

Urban centers are composed of an incessant flow of activities, materials, energy, and pollutants that may generate stress, anxiety, and fatigue. Effectively, in the conception of environments, the detachment from nature, the imposition of large-scale constructive standards, and the insufficient use of suitable and locally sourced materials may cause harmful effects on the planet, in addition to impacting the physical and psychological health of communities.²

Moreover, the restrictions imposed by the COVID-19 pandemic (example: prolonged permanence in the same spaces, physical distancing, and need for good ventilation) drastically amplified the changes in the human-environment relationship that have already been occurring in recent decades. Thus, it has become essential to rethink and adapt the domestic and public spaces to prevent diseases, promote health and increase the quality of life.³

Given this scenario, it is necessary to mention the potential of the biosphere itself as an inspiring source for projects and initiatives intended to overcome adversities and encourage sustainability. In fact, nature has a myriad of organisms that interact in complex cycles, structured in dynamic equilibrium. That is, the natural environment reveals numerous successful adaptations, which can guide the search for solutions to contemporary challenges.^{1,4}

In recent decades, biophilia and biomimicry have emerged as fields of knowledge focused on these themes. It is worth clarifying that biophilia focuses on the emotional and innate connection of human beings with nature.^{5, 6} That is, the predisposition by some spatial configurations that encompass natural elements. According to Browning and his collaborators, when incorporating biophilic aspects in a project, it is possible to obtain performance and health improvements.^{2, 7}

To illustrate some benefits of this approach, it is worth mentioning that, in the personal sphere, biophilia improves the perception of well-being. In the educational scope, better results and more focus are obtained. In commercial facilities, it improves the customer experience and prolongs their permanence in such places. In workspaces, it is possible to reduce absenteeism and increase productivity. In hospitals, natural elements can contribute to the recovery of patients (decreasing

anxiety and stress), promoting restorative sensations and well-being.⁷ Figure 1 presents the 14 patterns of biophilic design.²

Similarly, biomimicry aims to generate innovations inspired by nature. In this field, biological notions support the development of projects, having great potential to improve the quality of life, including stimulating behaviors that meet the current sustainability requirements.^{1, 4} It is relevant to clarify that the resources are not extracted directly from the natural environment. The strategy is to seek abstractions and inspirations from organic models. Biomimicry stimulates the reconnection of humans with the biosphere, emphasizing the importance of preserving biodiversity for current and future generations.^{1, 4, 8, 9, 10} In biomimetic design, natural forms, processes, and behaviors are explored. In addition, it is possible to investigate the complex interrelations in ecosystems.⁴ Figure 1 illustrates the principles of biomimetic design.⁴



Visual Connection with Nature A view to elements of nature, living systems and natural processes

Non-Visual Connection with Nature

deliberate and positive reference to nature Non-Rhythmic Sensory Stimuli Stochastic and ephemeral conne

ral connections with nature Thermal & Airflow Variability

rature, humidity and airflow that mimic natural environments

Presence of Water Enhances the experience of a place through seeing, hearing or touching water

Dynamic & Diffuse Light arving intensities of light that create conditions that occur in nature **Connection with Natural Systems** (seasonal and temporal changes)

Biomorphic Shapes & Patterns Symbolic references to natural pattern configurations and arrangements

NATURAL ANALOGUES

Material Connection with Nature aterials and elements that reflect the local ecology and create a distinct sense of pla

Complexity & Order Rich sensory information that adheres to a spatial hierarchy similar to natural configurations

NATURE OF THE SPACE

Prospect An unimpeded view over a distance, for surveillance and planning

Refuge A place for withdrawal from the main flow of activity (the individual is protected from behind and overhead)

Mystery The promise of more information, through strategies that entice the individual to travel deeper into the space

Risk/Peril ntifiable threat combined with a reliable safeguard



BIOMIMICRY LIFE'S PRINCIPLES

Figure 1. Principles of biophilia and biomimicry.^{2, 4}

There are numerous contributions from biological studies to health design, being pertinent to highlight some examples at different scales. The study of microstructures on porcupines which, for their good adhesion and reduction in the force for penetration into tissues, inspire more efficient and less painful medical devices, such as needles.¹¹ Research on species (example: lotus, geckos, and sharks) whose

nanostructures reveal possibilities to create materials and antibacterial surfaces which can ensure better sanitization of objects and spaces.¹² In odontology, there are biomimetic applications for dental restoration.¹³ On the architectural scale, there are also interesting designs based on biological knowledge, focused on health and quality of life, as highlighted in the publications of Browning and his collaborators, and Pawlyn.^{2, 7, 14} These authors underlined the importance of adopting bioinspired principles in projects, such as: good air circulation; natural lighting; vegetation and green infrastructures; and well-structured spatial hierarchy favoring good wayfinding. Such aspects can generate multisensory, invigorating, and restorative experiences.

In addition, when the importance of adapting human spaces to maintain communities safe and stimulate well-being is considered, with a view to restrictions imposed in the current pandemic period, health projects become crucial.^{2, 3, 7}

In summary, considering such assumptions, a descriptive and exploratory study was undertaken with the main purpose of identifying, describing, and classifying biophilic and biomimetic-based projects aimed at creating materials, objects, and spaces that contribute to preventing diseases and promoting health and quality of life.

METHOD

The methodology of 'multiple case study' was chosen. According to Yin, this approach enables the investigation of contemporary phenomena in the real world, aiming to clarify a set of actions, its results, and impacts.¹⁵ The researcher has restricted control over the analyzed situations, that is, it is not possible to manipulate objects or phenomena. A variety of sources can be implemented in this approach, such as documents, images, observations, and interviews.^{15, 16} Thus, through the analysis, comparison, and critical interpretation of data collected in the literature, it is possible to establish new relations.^{15, 16, 17}

Given the chosen method, 10 cases of 'nature-based design' were selected, aiming to compose a set with high variability of proposals related to different scales of human production. Consequently, the research was organized from data obtained in the biomimicry interactive online database Ask Nature, and in general literature - such as publications available on Terrapin Bright Green, Biomimicry Institute, and other websites.

Initially, each selected case was examined according to the following general axes: a) disease prevention, health promotion, and quality of life; b) general characterization of design aspects (materials, objects, and/or spaces); c) association of projects to biophilic and biomimetic principles. Subsequently, a comparative analysis of the set was carried out.

MULTIPLE CASE STUDY

For a better comprehension of the work reported here, each of the cases analyzed will be summarized, highlighting their general contributions to the field of health, well-being, and quality of life:

Case 1 - Sharklet Antibacterial Film is a material whose microstructure was inspired by dermal denticles of shark skin. It inhibits the growth and multiplication of bacteria, helping to keep surfaces clean. It avoids the use of chemical products and other biocides strategies, which can increase the level of resistance of bacteria when applied ostensibly. It can be used in high circulation environments, namely in public spaces and hospitals. In the scope of global health, the initial repercussions of the COVID-19 pandemic highlighted the importance of cleaning and sanitizing surfaces.^{18, 19, 20}

Case 2 - Metalmark filters is an air purification system inspired by butterfly wing nanostructures, which are combined with catalysts. It eliminates a wider range of particles than common filters. This

efficient product removes pollutants and pathogens from the air (including VOCs and ultra-fine particulates) and operates at low temperatures, which facilitates its use in residential, commercial, and industrial environments. Above all, it is clear that air pollution is a global issue, especially in large urban centers. With the pandemic, the importance of ensuring good air quality indoors and outdoors was established, to reduce the spread of the virus through droplets and airborne particles.^{18, 21, 22}

Case 3 - consists of a "self-cleaning" product inspired by the hydrophobicity of lotus leaves. Through the simple action of water, the Lotusan exterior wall coating makes it unnecessary to use chemicals and common paints to clean surfaces and façades from algae and fungi. As in Case 1, this product can be relevant in public and hospital spaces, in addition to being important for places with high levels of humidity.^{18, 23, 24}

Case 4 - the Vesta face mask is Brazilian personal protective equipment (type N95). The easy-toproduce, low-cost, and biodegradable filter material is composed of chitosan nanoparticles (made from shrimp shells). It is worth insisting that, due to the sanitary measures imposed by the pandemic, there is a growing demand for equipment capable of retaining and deactivating viruses and bacteria.^{18,} ^{25, 26}

Case 5 - inspired by leafcutter ant mounds and the foliage of Espeletia, Cooltiva is a passive system for cooling and ventilating buildings that reduces the dependence on air conditioning systems. Its ceramic composition – combined with the constant watering of the plants inside the device – refreshes the air that flows through the structure. This product also strengthens the human connection with nature by integrating vegetation into the façade, enhancing biophilic restorative sensations, which can promote well-being. $^{27, 28}$

Figure 2 provides illustrations of these first five cases.



Figure 2. Sharklet microstructure²⁰ (a); representation of the Metalmark filter nanostructure²² (b); lotus plant that inspired Lotusan²³ (c); Vesta respirator²⁵ (d); and Cooltiva module²⁷ (e).

Case 6 - the Microclimate Generator Screen Wall is a modular product based on Voronoi model tessellations. This parametric shading device, composed of coconut fibers, is biodegradable and suitable for hot climate buildings. It integrates a set of elements that provide thermal comfort and visual contact with organic shapes.²⁹

Case 7 - Votu Hotel is a project to be implemented in Bahia, Brazil. The shape of its bungalows results from the functional abstraction of prairie dog burrows (renewal and air circulation) and the rib structure found in cacti (shading). Natural elements are integrated into the space through gardens and green roofs. The final project is adapted to the characteristics of the place (hot climate), ensuring

ample natural ventilation and thermal comfort. It is believed that this proposal can encourage safer, more comfortable, and sustainable tourism.³⁰

Case 8 - the Eastgate Center is a shopping and commercial center in Harare, Zimbabwe. In this construction, materials with high thermal capacity are combined with an efficient passive ventilation system (inspired by termite mounds) that cools the building throughout the day. Therefore, it does not require the use of air conditioning systems, which would be indispensable in conventional constructions at this location. The wide circulation and renewal of air between floors are examples of design strategies to be considered, particularly in the pandemic and post-pandemic contexts. On the building's façade, there are also planters that, with the shading and evapotranspiration provided by the vegetation, also help maintain thermal comfort^{-18, 31, 32}

Case 9 - Paley Park is an urban pocket park in New York that opened in 1967. It remains a good example of how to transform a small space, surrounded by an intense urban verticalization, into a "restorative oasis." In this place, there is a combination of biophilic factors: vegetation, natural ventilation and lighting, seating variability, and a waterfall, which create a pleasant and highly frequented environment. It is an inspiring design for new urban spaces where it is intended to promote safe and outdoor community interaction.³³

Case 10 - Östra Hospital is a psychiatric facility designed to provide broad access to nature – direct and indirect, both inside and outside the building – for patients, doctors, and the staff. It has well-designed wayfinding due to its modular plan arranged in "L"-shaped departments. This is an example of how the integration of natural elements can favor the treatment and well-being of patients and improve the performance of healthcare teams.³⁴

Figure 3 shows illustrations of cases 6 to 10.



Figure 3. Microclimate Generator²⁹ (a); Votu Hotel's bungalow and ventilation system³⁰ (b); Eastgate Center and ventilation system³² (c); Paley Park³³ (d); Views of the Östra Hospital³⁴ (e).

Comparative Analysis

Table 1 presents the classification of each case according to type; congruence with biomimetic⁴ and biophilic² principles; benefits in health and quality of life.

Categories Type		Biomimetic principles	Biophilic principles	Health and quality of life benefits	
Case 1	Material	Life-friendly chemistry; resource-efficient; development & growth	Biomorphic patterns	Clean and safe surfaces, avoid the use of chemical products for disinfection	
Case 2	Material	Life-friendly chemistry; resource-efficient; development & growth	Biomorphic patterns	Air cleaning and filtration	
Case 3	e 3 Material Life-friendly chemistry; resource-efficient; development & Biomorphic patterns & growth		Only water is needed to clean surfaces		
Case 4	Material / object	Life-friendly chemistry; resource-efficient; development & growth	Biomorphic patterns	Facial protection that prevents contamination	
Case 5	Object	Life-friendly chemistry; resource-efficient; development & growth; locally responsive; adaptability	Visual & material connection; thermal & airflow variability; connection with natural systems	Thermal comfort and ventilation (passive systems). Access to vegetation	
Case 6	Object	Life-friendly chemistry; resource-efficient; development & growth; locally responsive; adaptability	Visual & material connection; thermal & airflow variability; connection with natural systems; biomorphic patterns; complexity & order	Thermal comfort (passive). Access to vegetation	
Case 7	Space	Resource-efficient; locally responsive; adaptability	Visual, non-visual & material connection; non-rhythmic stimuli; thermal & airflow variability; dynamic light; connection with natural systems; biomorphic patterns; complexity & order; prospect; refuge	Thermal comfort and ventilation (passive systems). Access to vegetation	
Case 8	Space	Resource-efficient; locally responsive	Visual, non-visual & material connection; non-rhythmic stimuli; dynamic light; material connection; complexity & order; prospect; refuge	Thermal comfort and ventilation (passive systems). Direct and indirect access to vegetation	
Case 9	Space	Resource-efficient; locally responsive; adaptability	Visual, non-visual & material connection; water feature; non-rhythmic stimuli; thermal & airflow variability; dynamic light; connection with natural systems; prospect; refuge	Open space, natural ventilation, and lighting, access to vegetation, restorative stimuli (waterfall), seating flexibility (more interaction)	
Case 10	Space	Resource-efficient; development & growth; locally responsive; adaptability	Visual, non-visual & material connection; non-rhythmic stimuli; thermal & airflow variability; dynamic light; connection with natural systems; complexity & order; prospect: refuge	Well-structured wayfinding, direct and indirect access to vegetation	

Table 1. Classification of cases.

When analyzing the table, it is noticeable that Cases 5, 6, and 10 included more biomimetic principles. These projects prioritized the use of non-toxic chemicals and biodegradable materials. They also implemented resources and energy efficiently, giving preference to multifunctionality, and adapting form to function in structuring their components. Given that aspects of the local climate were considered, they are responsive and well-adapted projects.

Cases associated with a wide range of biophilic principles corresponded to projects of spaces (Cases 7, 9, and 10). Possibly, this connection was expressive, as biophilia is closely related to the presence of natural elements in spaces and to the way in which individuals interact with such aspects.

The projects highlighted the relevance of producing a multisensory connection with nature – visualization of natural elements, light variability, auditory and olfactory stimuli, and biomorphic

patterns. Many of these criteria converged to generate thermal comfort and ample ventilation. Contact with flora and fauna in gardens gives rise to non-rhythmic sensory stimuli in the short term and connects users with natural systems in the long term (seasonal variations).

The organization of space factors into complex and modular biomorphic patterns provides wellstructured wayfinding and improves the experience of places. It is worth mentioning that Case 9 was the only one that explored a water element as a biophilic aspect, responsible for reducing temperatures and humidifying the place, in addition to producing a pleasant sound. Cases 7, 9, and 10 adopted an inclusive approach of perspective and refuge in their structural organization. The combination of these aspects can be relevant given the need to create new designs that are adequate to the sanitary and social distancing measures imposed by the pandemic. Consequently, it is believed that it is advantageous to generate refuge spaces for small groups of people, in open and well-ventilated areas, in an environment with access to expansive views of nature.

Considering the pandemic and post-pandemic period, in the cases presented in this paper, some important factors were evidenced to keep environments both inviting and safe for people, avoiding contamination. In this sense, it is possible to mention some strategies, which will be summarized below.

Using technologies and materials composed of bio-inspired nanostructures with cleaning and filtering action can contribute to keeping places more sanitized (Cases 1 to 4). In addition, the need to maintain good ventilation and safety of the air is reiterated (Cases 2, 5, 6, 7, 8, and 9). It is also vital to design more biophilic open public spaces – especially in dense and vertical urban environments (Case 9).

It should be noted that, specifically with regard to the presence of natural elements in urban spaces, there are multiple possibilities to be explored, whether in the creation of parks, gardens, green roofs, or community gardens. These proposals combine several advantages, as they can bring community members closer together. They may promote new interactions (including the encouragement of physical activities), as well as help to generate a sense of belonging to the place. As previously mentioned, contact with green spaces is important and is associated with a reduction in stress and anxiety.^{2, 7, 35}

Another advantage of including vegetation in spaces is its important sustainable role in: reducing local microclimate temperatures through evapotranspiration; carbon dioxide absorption; oxygen production; rainwater absorption; and capture of air pollutants.³⁵

CONCLUSION

This study allowed to verify that natural inspiration, when directed to health design, has multiple benefits, on several productive scales (microscopic and macroscopic). Some guidelines identified in the discussed cases, which can inspire new projects, are: prioritize ventilation; keep the surfaces sanitized; use clean and accessible energies; design energy-efficient and passive systems; allow for wide access to nature; avoid harmful chemicals; generate multisensory experiences; stimulate care for the place; and encourage safe interactions between people in open areas.

To summarize, biomimicry and biophilia provide opportunities for inspiring architectural and design creations, restorative of body and mind, and, ultimately, more integrated into urban and natural ecosystems. Indeed, these fields of bioinspiration deserve to be further explored, considering that they can expand the framework of perspectives available to designers, offering new possibilities. It is recommended that more research be carried out with a systematic foundation in bioinspired design knowledge to investigate its interfaces with the health area.

NOTES

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⁴ Dayna Baumeister et al., *Biomimicry Resource Handbook: A Seed Bank of Best Practices* (United States of America: Biomimicry 3.8, 2014), 1-285.

⁵ Stephen Kellert and Edward O. Wilson, *The Biophilia Hypothesis* (United States of America: Island Press, 1993), 1-496.

⁶ Stephen R. Kellert, "Dimensions, Elements and Attributes of Biophilic Design." In *Biophilic Design: The Theory, Science and Practice of Bringing Building to Life*, ed. Stephen R. Kellert, Judith Heerwagen and Martin Mador (United States of America: John Wiley & Sons, 2013), 3-19.

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⁹ Victor Papanek, *Design for the Real World: Human Ecology and Social Change* (London: Thames & Hudson, 1985), 186-214.

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¹⁴ Michael Pawlyn, *Biomimétisme & Architecture* (Paris: Rue de l'Échiquier, 2019), 10-102.

¹⁵ Robert K. Yin, *Estudo de Caso: Planejamento e Métodos* (Porto Alegre: Bookman, 2001), 14-38.

¹⁶ Matthew B. Miles and Michael Huberman, *Qualitative Data Analysis: An Expanded Sourcebook* (Califórnia: Sage, 1994), 1-352.

¹⁷ Alber Neto and Iago Bersot Arruda, "A Abordagem de Estudo de Caso e a Área de Arquitetura, Urbanismo e Design: Considerações a Partir da Análise de um Periódico," Revista Perspectiva Online: Humanas & Sociais Aplicadas 19, no. 7 (2017): 39-47, accessed January 7, 2022, doi: 10.25242/887671920171175.

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¹⁹ "Antibacterial Film Inspired by Sharks: Sharklet Technologies," Ask nature, accessed January 7, 2022, https://asknature.org/innovation/antibacterial-film-inspired-by-sharks/.

²⁰ "The Technology of Sharklet." Sharklet, accessed January 7, 2022, https://www.sharklet.com/.

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²² "Turning Contaminated Fumes into Breathable Air," Metalmark, accessed January 7, 2022, https://www.metalmark.xyz/.

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LOCKED DOWN AND LOCKED OUT: THE ROLE OF THE BUILT ENVIRONMENT IN THE EXCLUSION OF DISABLED PEOPLE DURING THE COVID-19 PANDEMIC

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INTRODUCTION

The COVID-19 outbreak, which was declared a pandemic by the World Health Organization (WHO) in March 2020 has disproportionately impacted disabled people who make up an estimated 15%, or one billion, of the global population which are disabled. The majority of disabled people (80%) live in developing countries¹. Despite the ratification of the United Nations Conventions of the Rights of Persons with Disabilities (UNCRPD) by 184 countries, most disabled people remain disadvantaged with many facing significant barriers around the built environment, health, education, employment, and poverty². Persistent stigma against disabled people leads to some unable or unwilling to identify or describe themselves as disabled³, and for many disabled people, impairment is created or compounded by the endurance of conflict⁴ or disasters⁵.

This paper explores the role of environment, place, and infrastructure in contributing to the barriers experienced by disabled people during the COVID-19 pandemic, drawing on a semi-systematic literature review of evidence on the impact of COVID-19 on disabled people in Low-and-Middle-Income Countries between March and December 2020⁶. The literature review, synthesising evidence from a wide range of sources, provides empirical evidence that disabled people have been systematically and comprehensively excluded from global, national, and local pandemic planning processes, and as a result, material barriers resulting from inaccessible environments and infrastructure were exacerbated during the first nine months of the pandemic.

Following an overview of our methods, we will discuss how our findings highlight the contribution of the built environment and infrastructure, as well as design and planning processes, to the marginalisation of disabled people during the COVID-19 pandemic. The discussion will then explore key learning points for both the general management of emergency planning, and for the planning and design of public and private spaces.

METHODS

The findings presented are based on a literature review of existing and emerging evidence of the impact of COVID-19 on disabled people in LMICs as well as evidence that emerged from previous large-scale pandemics, epidemics and other disasters. It used the principles of a systematic literature review to identify both peer-reviewed evidence and 'grey' literature including UN reports and briefings, reports from Non-Governmental Organisations (NGOs), and evidence compiled by

Disabled People's Organisations. Searches across eight social science databases, Google Scholar, and the UN official document systems yielded 893 articles, which were subjected to a light-touch review to confirm relevance, i.e. that they provided actual data on disabled people in LMICs during COVID-19, and excluding opinion pieces, guidance, or recommendation documents.

Following this review process, 113 were selected for close review, including 99 articles related to COVID-19 and 14 focusing on other disasters or emergencies. 'Grey' literature represented the majority of the literature reviewed with 67 out of 113 articles, with almost half of these coming from NGOs (31). Most of the identified literature on COVID-19 emerged early during the pandemic, with almost two thirds (64%) published between March and June 2020. A coding schedule was developed inductively to group recurring issues into themes that emerged from the literature, which were then summarised into a literature review report.

RESULTS

In this section, we will discuss how five themes emerging from the literature review related to aspects of the built environment and infrastructure. These five themes including inaccessible buildings, spaces that contribute to institutionalisation, transport and road networks, information technology infrastructure, and the divide between rural and urban spaces.

Inaccessible buildings

The evidence suggests that structural access barriers to buildings were worsened during the pandemic, both through an exacerbation of existing barriers and the creation of new barriers. New barriers were created through the creation of purpose-built treatment and quarantine centres for COVID-19 without considering access for disabled people, including entry to the buildings or accessible beds and toilets⁷. In addition, local and national policies did not take into account disabled people's support requirements during treatment or quarantine. As a result, disabled people were separated from personal assistants or caregivers, leaving them without essential assistance with personal needs and communication with healthcare staff⁸.

The reasons for the exacerbation of inaccessibility to buildings were twofold. Firstly, changes to buildings such as one-way systems Seor queuing guidelines did not take into account the requirements of people with different impairments, including blind people and those with intellectual impairments⁹, and counterproductively increased the need to touch surfaces to aid navigation¹⁰. Secondly, there is evidence that disabled people using mobility aids in order to navigate inaccessible buildings found that they were unable to maintain these aids or access new aids during the pandemic, as these services were frequently deemed 'non-essential' and therefore shut down¹¹, alongside other specialist disability healthcare services¹².

Reports of inaccessibility were not confined to healthcare, but also includes public spaces, and in particular schooling. Prior to the pandemic, around 50% disabled children living in LMICs were already not attending school¹³. School space is often limited and therefore any changes on how it used in order to adapt to the pandemic therefore risked further excluding disabled students¹⁴. In addition, inaccessibility of buildings affected disabled people's ability to take prevention measures to protect themselves COVID-19 infection, particularly regarding access to Water, Sanitary, and Hygiene (WASH) facilities. WASH infrastructure is often poorly developed in LMICs¹⁵. Lack of access to running water in many houses and informal settlements leads to reliance on public spaces or schools in order to access handwashing facilities, as these were often also closed due to the pandemic, or inaccessible due to structural barriers¹⁶.

Institutionalising spaces

The review highlighted the significance of space to COVID-19 risk, especially with regards to spaces that were worst affected by COVID-19. Globally, disabled people make up the majority of institutionalised people¹⁷. People in residential institutions accounted for 42% to 57% of all COVID-19 deaths in some countries¹⁸, although crucially disaggregated data on disability status had not been collected in many countries. Evidence suggests that the pandemic has had a devasting impact on those living in institutions¹⁹. In addition to this lack of space and WASH facilities led to an increased risk of transmission²⁰. Material space thus directly increased the risk for older and disabled residents. In addition, policies which limited or prohibited visitors further increased the isolated nature of residential facilities, with few governments taking specific measures to protect residents²¹. The resulting lack of accountability made it challenging to assess the exact impact on residents in institutions, though some harrowing evidence has emerged of increased neglect and human rights abuses²². The global Disability Rights Monitor report details instances of disabled people being deprived of their liberty by being confined to institutions, and isolated from friends or families as well as independent human rights authorities²³. The report highlights the case of a psychiatric facility Guatemala where 300 disabled people were confined to their institutions without physical distancing or access to medical care²⁴. In addition, some reports have suggested that some disabled people were forcibly institutionalised during the pandemic under the guise of preventative measures²⁵.

As well as residential and psychiatric institutions, several other spaces were highlighted in the literature as increasing both the risk of COVID-19 and of human rights violations. These included migrant and refugee camps, slums, prisons, and public spaces populated by homeless people. In Lebanon, which has the largest proportional percentage of refugees worldwide²⁶, households composed of Syrian (83%) and Palestinian (78%) households were considerably more likely to not be able to meet their essential needs, compared to Lebanese households (69%)²⁷. Palestinian refugees in Lebanon were also three times more likely to die with COVID-19²⁸. Like residential institutions, these spaces are characterised by being overcrowded, unsanitary, and inhibiting access to accurate information about COVID-19. In addition, disabled people are also overrepresented amongst populations in these spaces²⁹. Refugee and migrant populations, as well as lacking access to healthcare and infection control, and being at higher risk of being economically impacted³⁰, also experienced greater level of psychosocial impacts such as depression, anxiety, and loneliness, as a result of the COVID-19 pandemic³¹.

Transport and road networks

Restrictions on public transport during lockdowns in many countries had a significant effect on disabled people, particularly affecting those living in rural locations, indigenous populations, and those living in informal settlements and camps³². In India, this was exacerbated by the other infrastructure problems such as the poor maintenance of roads and footpaths, leaving disabled people unable to navigate independently without the reliance on transport³³.

Where public transport provision was still in place, disabled people were often not considered in service planning³⁴. For many disabled people living in the community, this increased isolation significantly restricted access to care, medical treatments, and essential items such as food and medicine. Access to emergency relief at central distribution point presented a particular barrier, particularly as little provision was made to prioritise disabled people or their families and caregivers³⁵, suggesting that even where emergency measures were taken, the operational logistics often rendered them ineffective in addressing urgent needs.

IT infrastructure

Disabled people's ability to remain connected with society, education, and friends and family via technology was significantly impacted by both a lack of access to and limited accessibility of technology. While many households in LMICs have little or no access to the internet or online devices, this is exacerbated for disabled people, who are more likely to be affected by poverty, and live in rural locations with limited or unreliable infrastructure³⁶. A global survey found that 31% of families had access to computers and 25% to tablets³⁷. In addition to cost of technological devices, ongoing data costs presented an additional barrier³⁸. In families where multiple members required technology in order to access employment or education, both disabled people, and women and girls were more likely to be deprioritised as their needs were considered less important³⁹.

The rural and urban divide

The pandemic had distinct impacts on both disabled people living in rural and urban areas. Around 70% of disabled people in LMICs live in rural areas⁴⁰. Many of the barriers already discussed, including lack of technological infrastructure, poor transport routes, and insufficient WASH facilities, were exacerbated in rural locations. In India for example, while over two thirds of the disabled population live in rural areas, only 21% of the rural population has internet access⁴¹. In addition, relief measures did not necessarily reach or consider people living in rural locations⁴². However, a report from Uganda⁴³ suggested that those living in rural areas where at an advantage to those in urban areas in terms of food poverty, as they were not reliant on supply chains and able to grow their own food.

Those living in urban areas were affected by potentially higher risk of injury or illness due to pollution⁴⁴, and overcrowding, increasing the risk of contracting COVID-19. In addition, higher costs of living increased the risk of poverty in urban areas⁴⁵. However, populations are not static, and a report from Indonesia suggests that migration between cities and rural areas increased for many disabled people during the pandemic, particularly for women⁴⁶. Migration from cities to rural areas has been identified as a key factor in communicating information about COVID-19 of rural areas that have limited access to official information channels⁴⁷, but where these networks were disrupted, this limited the information received by those in rural areas. Migrants, including internal migrants, also faced an increase in xenophobia during the pandemic, due to fears that they could spread COVID-19⁴⁸.

DISCUSSION

The results section has highlighted some of the key data emerging on disability and COVID-19 in LMICs, however perhaps more notable is the lack of empirical data in many areas. Quantifying the effect on disabled people is made impossible due to lack of disaggregated data collected at local, national, and international levels. In particular, data on infection and death rates, as well as the economic impact of the COVID-19 pandemic on disabled people, is not being collected or published by the vast majority of countries. This mirrors previous major disasters and international emergencies, where little data on disability was published, and there is little evidence of any concrete change for disabled people as a result.

While there are considerable gaps in data, there are nevertheless key themes emerging. This research therefore identifies two key priorities. Firstly, the establishing of systematic measures to collect data that can be disaggregated by disability status, as well as other marginalised categories, such as gender, sexuality, ethnic group, class, and refugee status. This data needs to be collected to assess both the ongoing and long-term impact of COVID-19. In addition, these measures should include planning for this data to be collected not just in relation to the pandemic, but generally to ensure there is baseline

information available to measure against any future changes in the COVID-19 pandemic or other emergencies or disasters.

The second priority is the need for disabled people to be included in planning processes. A clear theme emerges from the 112 articles and report reviews that disabled people were excluded from any emergency pandemic planning across the globe. The neglect of disabled people and lack of consideration for the additional barriers they faced and continue to face during the pandemic likely contravenes the disabled people's rights under the UNCRPD. Moreover, it reflects the everyday exclusion of disabled people in general design and planning processes; the built environment continues to creates barriers "which legitimise oppressive and discriminatory practices against disabled people".⁴⁹. Adopting the principles of universal design and involving disabled people in any planning and design processes, whether emergency or routine, are crucial to ensure that disabled people's needs are considered, and disabled people's expertise of their own experiences recognised.

The widespread evidence on the neglect of disabled people during the pandemic also reinforces the importance of understanding disability as a form of marginalisation and social oppression. Planning and design approaches that do not consider to disabled people often do so because disability is regarded as an individual tragedy, that needs to be treated or cured in order for disabled people to conform as much as possible to a 'normal', non-disabled stereotype. The continued prevalence of this 'medical model' approach⁵⁰ to disability is confirmed by the findings of the literature review. Adoption of a 'social model' approach, which recognises disability as caused by the social barriers which isolate and exclude people with impairments from society⁵¹, is essential to effective planning of a built environment that is accessible to all.

The recovery from the COVID-19 pandemic provides the opportunity to reimagine how spaces can be used differently to achieve better access for disabled people across the globe. One particularly urgent aspect in light of the human rights abuses during the COVID-19 pandemic is the need to support the deinstitutionalisation of disabled people who are incarcerated in residential facilities. In many LMICs, disabled people living in the community are cared for informally by family and friends, due to both an absence of official support and cultural reasons⁵². Consideration needs to therefore be given on how the built environment and supportive policies can facilitate disabled people to live in the community, in consideration with local Disabled People's Organisations who are able to provide lived expertise.

CONCLUSION

This paper has discussed the impact of structural barriers caused by the built environment and infrastructure on disabled people in LMICs during the COVID-19. It is clearly that both these structural barriers, as well as cultural and attitudinal views of disability as an individual tragedy have exacerbated the poverty, stigma, and exclusion of disabled people across the globe. While disabled people have frequently been described as vulnerable due to 'pre-existing conditions'⁵³, they are in fact made so due to structural barriers. It is therefore imperative that policymakers, planners, and designers understand disability as socially produced and human rights issue, which cannot be addressed as an afterthought, but necessitates the proactive collaboration with disabled people and their organisations in order to ensure that no-one is left behind.

NOTES

¹United Nations. Policy Brief: A Disability-Inclusive Response to Covid-19 (2020).

² Tom Shakespeare. "Disability in Developing Countries." In *Routledge Handbook of Disability Studies*, ed. Nick Watson and Simo Vehmas. (Abingdon:Taylor & Francis Group, 2019).

³ Maria Berghs. "Radicalising 'Disability' in Conflict and Post-Conflict Situations." Disability & Society 30 (2015).

⁴ See Berghs, "Radicalising 'Disability.'". See also Victor S. Pineda and Jason Corburn, "Disability, Urban Health Equity, and the Coronavirus Pandemic: Promoting Cities for All." Journal of Urban Health-Bulletin of the New York Academy of Medicine 97,3 (2020): 336-41.

⁵ Dolores E. Battle, "Persons with Communication Disabilities in Natural Disasters, War, and/or Conflict." Communication Disorders Quarterly 36,4 (2015).

⁶ Vera Kubenz and Dina Kiwan, *The Impact of the Covid-19 Pandemic on Disabled People in Low- and Middle-Income Countries: A Literature Review*. University of Birmingam (2021).

⁷ See Disability Working Group, *Fact Sheet: The Reality of Persons with Disabilities in the Gaza Strip During Corona Pandemic.* Disability Working Group (2020). See also Pratima Gurung and Krishna Gahatraj, *Covid-19 and Its Impact on Persons with Disabilities and Marginalized Groups in Nepal.* National Indigenous Disabled Women Association Nepal (NIDWAN) (2020) and National Federation of the Disabled Nepal, *Impact of Covid-19 Pandemic and Lockdown on Persons with Disabilities: A Rapid Assessment Report.* National Federation of the Disabled Nepal, 2020).

⁸ See Laura Guidry-Grimes *et al*, "Disability Rights as a Necessary Framework for Crisis Standards of Care and the Future of Health Care." *The Hastings Center report* 50,3 (2020). See also Emma Pearce, *Disability Considerations in Gbv Programming During the Covid-19 Pandemic.* Gender-Based Violence AoR (2020)

⁹ See Gerard Goggin and Katie Ellis, "Disability, Communication, and Life Itself in the Covid-19 Pandemic." *Health Sociology Review* 29,2 (2020). See also Yana Zayed, *et al*, *Amplifying Voices: Our Lives, Our Say Learning from Covid-19 through the Experiences of Blind and Partially Sighted Persons across the World.* World Blind Union (Toronto, Canada: 2020).

¹⁰ Yana Zayed et al, Amplifying Voices.

¹¹ See "Two Stories from South Africa: How a Simple Consultation Could Prevent Current Massive Problems" International Disability Alliance (2020), accessed 12/10/2020, https://www.internationaldisabilityalliance.org/SA-Covid19. See also Emma M. Smith *et al*, "Assistive Technology Use and Provision During Covid-19: Results from a Rapid Global Survey." *International journal of health policy and management* (2020).

¹² See Disability Working Group, *Fact Sheet*, Nidhi Goyal *et al*, *Neglected and Forgotten: Women with Disabilities During the Covid Crisis in India.* Sightsavers, Rising Flame (2020), and "Cut from the World: Pandemic Experience for Hard of Hearing Persons in Nepal." Voices of International Disability Alliance (2020), accessed 12/10/2020, https://www.internationaldisabilityalliance.org/nepal-covid19. See also Emma L. McKinney *et al*, "Covid-19, Disability and the Context of Healthcare Triage in South Africa: Notes in a Time of Pandemic." *African Journal of Disability* 9 (2020).

¹³ See Joao Pedro Azevedo et al, Simulating the Potential Impacts of Covid-19 School Closures on Schooling and Learning Outcomes: A Set of Global Estimates. World Bank Group (2020). See also UNICEF. Ensuring an Inclusive Return to School for Children with Disabilities. (2020).

¹⁴ UNICEF. Ensuring an Inclusive Return.

¹⁵ See Guday Emirie *et al, Experiences of Vulnerable Urban Youth under Covid-19: The Case of Youth with Disabilities.* Gender & Adolescence: Global Evidence (London: 2020) and "How Is It to Be a Refugee with Disability During the Pandemic? Stories from Kenya to Myanmar" International Disability Alliance (2020), accessed 12/10/2020, https://www.internationaldisabilityalliance.org/covid19-refugees. See also McKinney *et al,* "Covid-19, Disability and the Context of Healthcare Triage".

¹⁶ See Water for Women Fund *et al*, *Disability Inclusion and Covid-19: Guidance for Wash Delivery: Guidance for Water for Women Fund Implementing Partners.* (Melbourne, Australia: 2020). See also Brigitte Rohwerder, *Disability Inclusive Development: Tanzania Situational Analysis.* Inclusive Futures, Institute of Development Studies (2020).

¹⁷ United Nations Human Rights. Covid-19 and the Rights of Persons with Disabilities: Guidance. (2020).

¹⁸ United Nations Human Rights. *Covid-19 and the Rights of Persons with Disabilities*

¹⁹ See Ciara S. Brennan *et al*, *Disability Rights During the Pandemic: A Global Report on Findings of the Covid-19 Disability Rights Monitor.* Validity Foundation (2020). See also Guidry-Grimes *et al*, "Disability Rights as a Necessary Framework". ²⁰ See Vincent A. Campbell *et al*, "Preparing for and Responding to Pandemic Influenza: Implications for People with Disabilities." *American Journal of Public Health* 99 (2009). See also Jess Meaney-Davis *et al, The Impacts of Covid-19 on People with Disabilities: A Rapid Review.* UK Aid Inclusive Futures (London, UK: Disability Inclusion Helpdesk 2020).

²¹ See Brennan *et al, Disability Rights During the Pandemic.* See also Dikaios Sakellariou *et al*, "Disability Inclusiveness of Government Responses to Covid-19 in South America: A Framework Analysis Study." *International Journal for Equity in Health* 19 (2020).

²² See Brennan *et al, Disability Rights During the Pandemic* and Pauline Castres and Maeve O'Reilly, *Mitigating the Global Impact of Covid-19 Whilst Fulfilling the Rights of Persons with Disabilities.* Leonard Cheshire (2020). See also Meaney-Davis *et al, The Impacts of Covid-19* and United Nations ESCWA and World Health Organization. *The Impact of Covid-19 on Older Persons in the Arab Region.* (2020).

²³ Brennan et al, Disability Rights During the Pandemic

²⁴ Brennan et al, Disability Rights During the Pandemic

²⁵ See Brennan *et al*, *Disability Rights During the Pandemic* and CBR Africa Network (CAN), *Report on the Impact of Covid-19 on Persons with Disabilities in Africa*. (2020). See also Andrea Pregel and Guy Le Fanu, *Including People with Disabilities in Responses to the Covid-19 Pandemic: Guidance for Development Partners May 2020.* Sightsavers (2020) and Women Enabled International, *Covid-19 at the Intersection Ofgender and Disability: Findings of a Global Human Rights Survey, March to April 2020.* (Washington, D.C.: 2020).

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²⁷ Naomi Clugston and Michelle Spearing, *The Likely Impacts and Risks of Covid-19 for People with Disabilities in Humanitarian Contexts, and Mitigation Measures.* UK Aid Disability Inclusion Helpdesk (2020).

²⁸ "Palestinian Refugees in Lebanon Three Times More Likely to Die with Covid-19." Thomson Reuters Foundation (2021), accessed 19/02/2021, https://news.trust.org/item/20210216153654-lwurk/

²⁹ See Pregel and Le Fanu, Including People with Disabilities and Sakellariou et al, "Disability Inclusiveness."

³⁰ See Lorenzo Guadagno, *Migrants and the Covid-19 Pandemic: An Initial Analysis.* International Organization for Migration (IOM) (Geneva, Switzerland: 2020), Humanity & Inclusion, *Covid-19 in Humanitarian Contexts: No Excuses to Leave Persons with Disabilities Behind! Evidence from Hi's Operations in Humanitarian Settings.* Humanity & Inclusion (2020) and Dominic Samaila *et al*, "Impact of Covid-19 Pandemic on People with Disabilities and Its Implications on Special Education Practice in Nigeria." *International Journal of Innovative Science and Research Technology* 5 (2020). See also Stephen Thompson, *Disability Inclusive Development: Bangladesh Situational Analysis.* Inclusive Futures, Institute of Development Studies (2020) and Vicki Xafis,""What Is Inconvenient for You Is Life-Saving for Me': How Health Inequities Are Playing out During the Covid-19 Pandemic." *Asian Bioethics Review* 12,2 (2020).

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³² See "Indigenous Persons with Disabilities in Mexico: Completely Forgotten During the Pandemic" International Disability Alliance (2020), accessed 12/10/2020, https://www.internationaldisabilityalliance.org/indigenousmexico-covid, National Centre for Promotion of Employment for Disabled People (NCPEDP). *Locked Down and Left Behind: A Report on the Status of Persons with Disabilities in India During the Covid*. National Centre for Promotion of Employment for Disabled People (NCPEDP) and Maryam Jalali *et al*, "Covid-19 and Disabled People: Perspectives from Iran." *Disability & Society* 35,5 (2020). See also Brigitte Rohwerder, Social Impacts and Responses Related to Covid-19 in Low- and Middle-Income Countries. Institute of Development Studies. (Brighton, UK: 2020) and Thompson, *Bangladesh Situational Analysis*.

³³ See Emirie et al, Experiences of Vulnerable Urban Youth and Goyal et al, Neglected and Forgotten

³⁴ See Humanity & Inclusion, *Covid-19 in Humanitarian Contexts* and "How Absence of Transport Can Be Fatal: A Story from Uganda." International Disability Alliance (2020), accessed 12/10/2020, https://www.internationaldisabilityalliance.org/covid19-story-uganda

³⁵ See Nilima Ahmed *et al: Double Jeopardy for People with Disabilities. Evidence on the Impact of Covid-19 on People with Disabilities in Bangladesh.* ADD International (2020) and Humanity & Inclusion, *Covid-19 in Humanitarian Contexts.* See also "The Story of Rose Rokiatou: Covid-19 Pandemic and Financial Vulnerability of Persons with Disability in Mali." International Disability Alliance (2020), accessed 12/10/2020, https://www.internationaldisabilityalliance.org/rose-covid19 and Meaney-Davis *et al, The Impacts of Covid-19*

³⁶ See Azevedo *et al*, Simulating the Potential Impacts of COVID-19, Brennan *et al*, Disability Rights During the Pandemic, Castres and O'Reilly, Mitigating the Global Impact of Covid-19, Goyal *et al*, Neglected and Forgotten and Tawanda Majoko and Annah Dudu, "Parents' Strategies for Home Educating Their Children with Autism

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³⁷ Charlotte McClain-Nhlapo *et al, Pivoting to Inclusion: Leveraging Lessons from the Covid-19 Crisis for Learners with Disabilities.* World Bank Group Washington, DC (2020).

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⁴² Rohwerder, Social Impacts and Responses

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⁴⁶ Tessa Hillgrove and Wesley Pryor, *Experiences of People with Disabilities in Covid-19: A Summary of Current Evidence.* Australian Aid, DID4All (Canberra, Australia:2020).

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⁴⁸ Guadagno, *Migrants and the Covid-19 Pandemic.*

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ANALYSIS OF PARENTAL PERCEPTION OF CHILD FRIENDLINESS OF THE NEIGHBORHOOD AND INFLUENCING FACTORS

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INTRODUCTION

Creating a child-friendly environment is one of the actions towards achieving sustainable cities.¹ The healthy development of children depends on how well neighborhood environments are designed for children, ² because neighborhoods are the first places where children interact with the world.³ By playing in the neighborhood, children can improve their physical health, social skills, interaction and mental wellbeing.⁴ However, children are seldomly considered specifically in the design of the neighborhood environment.⁵

Some studies have stressed the role of adults in creating more child friendly environments.⁶ Parents are important gatekeepers and decision references for their children's physical activity.⁷ How parents perceive, use, and attach importance to neighborhoods is important for understanding the influence of neighborhood environment on children's behaviors. McAllister has argued that planners should create urban spaces where parents feel safe enough to allow their children to explore.⁸ So, parents' perception of child friendliness plays an important role in developing child friendly neighborhoods. However, there is no suitable and comprehensive existing measurement instrument to measure perception of child friendliness of neighborhood as a whole for further research.

Existing studies have usually used *perceived* physical environment factors⁹ and ignored how the perceptions are affected by the objective physical environment. Although physical aspects of the environment can be measured by self-reports, objective measures potentially have fewer biases.¹⁰ Several researchers have found that objective neighborhood environmental characteristics have only a poor agreement with perceived characteristics.¹¹ The reason may be that different people who live in the same neighborhood have different perceptions of environmental characteristics.¹² Findings based on objective measures of the physical environment may provide more useful suggestions for policy makers to invest in changes to city infrastructure. Therefore, this study will use objectively measured physical environment variables. The aim of this study is to look into parental perception of child friendliness.

LITERATURE REVIEW

Environmental child friendliness is a complex multi-dimensional and multi-level concept and a great number of studies have tried to determine a definition and potential criteria of child friendly environments.¹³ Relevant studies have included safety, green space, variety of activity settings, independent mobility, affordances, active socialization and integration of children as essential criteria of environmental child friendliness.¹⁴ Although there is an abundance of relevant studies, few definitions and evaluation frameworks of child friendliness have been used to evaluate the child friendliness of different types of physical neighborhood environments. The reason may be due to the abstractness and broadness of these definitions. They were usually used to measure objective child friendliness of neighborhoods or by mixing both objective and perceived child friendliness.¹⁵ Another attempt to define the concept of child friendliness is grounded in the United Nations Convention on the Rights of the Child. According to the United Nations Children's Fund (UNICEF), children have 'the rights to express opinions, participate in the community, receive basic services, be protected from various forms of violence, walk safely, play, have greenspaces, live in an unpolluted environment and be treated equally'.¹⁶ Arlinkasari and Cushing indicated that 'a child friendly environment provides opportunities which support children to achieve their needs and goals (i.e. to move freely, to interact with others, to access services, to manage exciting activities, and to feel safe)'.¹⁷ However, they did not indicate what the children's needs and goals are, and they also did not present a measurement instrument. According to these studies, it can be concluded that the common denominator of the concepts is that children mainly have five rights and needs: to move freely, to meet friends, have access to basic services (education, transportation, heath, recreation), have access to green space, and to be safe. Revised from the study of Arlinkasari and Cushing, perception of child friendliness in neighborhoods can be indicated whether people think that the neighborhood provides children with opportunities that support their five rights and needs. This definition will be used to design the measurement instrument of perception of child friendliness. In sum, a child friendly environment accommodates all these basic needs and stimulates children to display healthy behavior.

Insights in what factors influence parental perception of child friendliness is very important for creating child friendly environments. The socio-ecological model is useful for studying the effects of different levels of factors influencing healthy behavior.¹⁸ This model considers different levels including the personal level, the household level, the physical and social environment. Rather than on child friendliness in general, most studies focused on certain aspects, such as independent mobility and safety, which are regarded as determining criteria a child friendly environment.¹⁹ Several factors from these different levels have been found to affect children's independent mobility and safety.

Many personal factors have been found to influence children's independent mobility and safety. Existing studies revealed that older children generally gain more independence in travel.²⁰ Boys have been found to be given more independence by their parents than girls.²¹ These differences suggest that parents have higher perception of child friendliness of their neighborhoods when their children are older or they have boys. Some researchers also found that sex, age and ethnicity are influencing factors contributing to people's neighborhood perceptions.²² Children who are not the only children or first-borns gain independence earlier.²³ Parents with higher levels of education are more likely to give their children more independence.²⁴ It has also been found that female parents/caregivers perceive road environments as more dangerous compared to male parents/caregivers.²⁵

For household characteristics, family type, length of residence in the neighborhood and household income have been found to be related to child friendliness. Children from single parent households are more likely to travel independently.²⁶ Parents who have higher household incomes perceive higher safety of their neighborhoods.²⁷ Parents who lived in the neighborhood longer are more likely to grant

their children independence.²⁸ Length of residence in the neighborhood may have positive effect on parental perception of child friendliness. Home environment such as presence of space at home has also been identified as factor of a child friendly neighborhood.²⁹ Therefore, dwelling type and size of garden may affect parental perception of child friendliness.

A number of studies evaluated child friendliness regarding physical environment mainly from the perspective of access to basic services, safety and green space.³⁰ Some researchers also found several physical environment factors affecting perceived safety. The presence of trees is contributing to greater perceived safety among adults.³¹ Parents' perceptions of safety was found to be associated with neighborhood traffic.³² Adults' perceptions of safety also have relationships with land use and green spaces.³³ Parents living in inner city neighborhoods have stronger safety concerns compared to those living in suburban neighborhoods.³⁴

The social environment variables such as social cohesion and neighborhood crime have also been found to affect parental perceived safety. It has been indicated that parents are more likely to have less safety concerns when they perceive higher social cohesion.³⁵ Socio-demographics of the neighborhood, such as age diversity and percentage of people with high education level have been used as indicators for the evaluation framework of child friendly neighborhoods as well.³⁶

METHOD

Measuring instrument

In this study, three ways were used to collect data. Firstly, a survey was developed for parents with children in grades 5-8 (aged 7-12 years old). The survey asked about personal and household characteristics, parental perception of child friendliness and social cohesion. The survey also asked the 6-digit postcode of each respondent that allowed us to link the survey data to spatial data sources. The measurement instrument of parental perception of child friendliness is based on children's five basic needs: to move freely, to meet friends, to have access to basic services (education, transportation, heath, recreation), to have access to green space and to be safe. As for moving freely, whether the neighborhood is suitable for children to walk or cycle around alone or with other children is considered. The assessment uses as variables whether children have friends to play or hang around with, know many friends in the neighborhood, meet friends on the way to school and have suitable places to meet friends and play with to address the right for meeting friends. The assessment of access to basic services focuses on four dimensions: suitable school, transit stop and good street connectivity, care facilities and recreation facilities. Whether there are many accessible green spaces is used as indicator of access to green space. As for safety, whether the neighborhood is safe for children to play, walk, cycle and travel to school is considered as key variable. These considerations are designed and shown in 15 statements (Table 1). Parents rated their agreement on a 5-point Likert scale (1 =strongly disagree to 5 = strongly agree). Cronbach's Alpha was 0.918 indicating good internal consistency. The scores for these 15 statements are combined into one general parental perception of child friendliness variable.

Social cohesion was assessed by using an existing scale which uses five statements³⁷ answered by parents on a five point scale: 'people around my neighborhood are willing to help their neighbors'; 'People in this neighborhood can be trusted'; 'People in this neighborhood generally do not get along with each other (reverse scored)'; 'People in this neighborhood do not share the same values (reverse scored)'; and 'Most of my friends live in this neighborhood'. The result of Cronbach's Alpha analyses showed that it would be better to delete the last item. The value of Cronbach's Alpha for the last four items was 0.689 which indicates moderate to good internal consistency. A sum score of the four statements was computed to represent social cohesion.

Secondly, this study used Geographic Information Systems (GIS) software to objectively assess a selection of physical neighborhood variables (Table 2) surrounding each participant's home identified based on 6-digit postcode. These variables include land use mix, percentage of residential area, percentage of green area of the neighborhood and distance to the nearest park, playground, swimming pool, sports-centre and bus-stop. Other objective variables are about street network metrics.

In addition, this study also used data on physical and social neighborhood variables (Table 2) from the Dutch Central Bureau of Statistics (CBS)³⁸. The physical neighborhood variables from CBS are urban density, facilities distance and number of facilities for primary school, nursery (day care) and general practitioner in the neighborhood. The social neighborhood variables include neighborhoods crime and socio-demographic composition of neighborhoods. The socio-demographic variables include age of population, population density, education level of population and average household income.

Parental perception of child friendliness				
		Statements	Cronbach's	
			Alpha	
1	To move	My neighborhood is suitable for my child to walk or cycle around alone or		
	freely	with other children (without an adult).		
2		There are many other children nearby with whom my child could play or		
		hang around		
3	To meet	My child knows many children in the neighborhood		
4	friends	My child often meets other children on the way to school		
5		My neighborhood provides plenty accessible places for my child to meet		
		friends and play together.		
6		There is a school nearby that is suitable for my child.		
7		From our home, it is convenient for my child to walk to a transit stop (bus,		
		train).	0.010	
8	Access to	There are many different safe routes for my child to get from place to	0.918	
	basic services	place in our neighborhood.		
9		My neighborhood provides all the necessary care facilities for my child.		
10		In my neighborhood there are many accessible recreation facilities (like		
		playgrounds or sports facilities) for my child to play.		
11	Access to	My neighborhood provides many accessible green spaces (trees, grass,		
	green space	parks and public green spaces) for my child.		
12		It is safe for my child to play in the neighborhood.		
13	T 1 (My neighborhood is safe for my child to walk around.		
14	To be safe	My neighborhood is safe for my child to cycle around.		
15		It is safe for my child to travel to school without an adult.		

Table 1. The measurement of parental perception of child friendliness

Variables	Description of reminking				
variables	Description of variables				
Physical environment					
	Five levels of address density from high to low: very high urban density,				
Urban density	high urban density, middle urban density, low urban density, and very low				
	urban density;				
	The distance from each participant's home to the nearest facilities: park,				
Facilities distance	playground, swimming pool, sports-centre, bus-stop;				
i defittes distance	The average distance of all residents in an area to the nearest facilities:				
	primary school, nursery (day care), general practitioner;				
	The average number of facilities within 1 km by road for all residents of				
The number of facilities	each neighborhood: primary school, nursery (day care), general				
	practitioner;				
Percentage of roads with speed	The percentage of roads with speed limit of 30 km/h or lower for the 1km				
limit of 30 km/h or lower	road network area around each participant's home;				
~	The ratio between the number of intersections (3 or more legs) and the land				
Street intersection density	area of neighborhood:				
	The number of crossings for the 1 km road network area around each				
Number of crossings	participant's home:				
Percentage of roads with separate	The percentage of roads with separate cycleways for the 1 km road				
cycleways	network area around each participant's home:				
	The percentage of each area within neighborhood: traffic area built-up				
Land use mix	area semi huilt-un area recreational area agricultural area etc.				
	The percentage of the area of different types of recreational space: sports				
Percentage of residential area	space and daily recreational space				
	The percentage of the area of different types of open green space: green				
Percentage of green area	The percentage of the area of different types of open green space. green				
Social anvironment	park space, forest, and open nature space, and finand water area;				
Social environment					
Social cohesion					
Neighborhoods Crime					
Theft	Departy animage registered by the police per type of anima evenessed in				
Crime against public order	Property crimes registered by the ponce per type of crime expressed in				
Violence and sexual offenses	number per 1000 innabitants in neignborhoods;				
	The percentage of each age class of each neighborhood: 0-15 years olds.				
Age of population	15-25 years olds 25-45 years olds 45-65 years olds over 65 years olds:				
Population density number of					
inhabitants per km ²	Population density per km ² of each neighborhood				
linaoitants per kin	The percentage of persons of each education level of each neighborhood:				
Education level of population	low advention loval secondary advention loval high advention loval				
Average standardized household	The average standardized household income of each neighborhood (y 1000)				
Average standardized nousehold	The average standardized household income of each neighborhood (× 1000				
income of neignborhood	euros) in 2018.				

Table 2. The list of physical and social environment variables

Data analysis

The on-line survey was distributed in July 2021 in the Netherlands. This study also used data from GIS software and CBS based on 6-digit postcode of each respondent. The data were analysed using stepwise multiple linear regression analyses to identify the significant variables and test the relationship of these variables with parental perception of child friendliness. Four models were estimated. The first one included only personal characteristics as explanatory variables. In model 2, household characteristics were added. In model 3 the characteristics of the physical environment were

added. The social environment characteristics were added in the final model. In this way, the relative importance of the different sets of variables for predicting the perception of child friendliness can be evaluated.

RESULTS

A total of 338 parents (39.6 % male and 60.4 % female) and their children (52.7 % boys and 47.3 % girls) consented and completed the study. Table 3 shows the sample characteristics.

Variables		Percentage	Variables	Mean	St. deviation
Personal level			Distance to swimming pool	2.49	2.01
	7	14.5	Distance to sports centre	0.85	0.56
	8	18.6	Distance to bus stop	0.15	0.12
	9	13.9	Distance to primary school	0.59	0.46
Age-child	10	14.8	Number of primary schools within 1 km	2.63	1.72
	11	21.6	Distance to nursery (day care)	0.45	0.22
	12	16.6	Number of nursery (day care) within 1 km	5.94	5.57
Condon	Male	39.6	Distance to general practitioner	0.75	0.53
parent	Female	60.4	Number of general practitioners within 1 km	2.10	2.22
Conden shild	Boy	52.7	Percentage of roads with speed limit of 30 km/h or lower	84.40	5.70
Gender-child	Girl	47.3	Street intersection density (number/ km ²)	109.22	89.86
0.11. 1	Single child/First child	24.3	Number of crossings	49.98	57.61
Sibling order	Second or above child	75.7	Percentage of roads with separate cycleways	41.74	10.20
Education	Low/ Secondary education	41.4	Land use for traffic area	6.56	6.00
level-parent	High education	58.6	Land use for built-up area	68.50	20.58
	Dutch	86.1	Land use for semi built-up area	3.92	9.95
Ethnic	Western immigrant	2.1	Land use for recreational area	11.39	10.94
	Non-western immigrant	11.8	Land use for agricultural area	3.03	7.90
Household level			Land use for forest and open natural terrain	1.50	6.89
Equily true	Two parents	77.5	Land use for back water	5.06	9.55
Family type	One parent	22.5	Land use for open water	0.03	0.27
Household income	Below and around the average (+/- € 2000)	65.4	Percentage of residential area	57.69	22.11
	Above the average	34.6	Percentage of green area	13.89	13.56
Dwelling	Apartment	19.8	Social environment		
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type	House (single family dwelling)	80.2	Social cohesion	13.87	2.59
	No garden	23.4	Neighborhood Crime		
	Garden: <25 m ²	15.1	Theft	4.19	2.75
Size of	Garden:25 m2-50 m2	34.9	Crime against public order	5.07	2.72
garden	Garden: 51 m ² - 100 m ²	18.3	Violence and sexual offenses	5.72	4.71
	Garden: more than 100 m ²	8.3	Percentage of 0-15 years olds	16.95	4.98
Physical environment			Percentage of 15-25 years olds	12.43	3.28
	Very high urban density	47.6	Percentage of 25-45 years olds	29.41	8.00
Urban Density	High/ Middle/ Low urban 50.6 Percentage of 45 density		Percentage of 45-65 years olds	26.48	5.52
	Very low urban density	1.8	Percentage of over 65 years olds	14.73	6.50
	Mean	St. deviation	Population density number of inhabitants per km ²	8325.27	6002.15
Personal level			Percentage of Low education level	27.62	10.40
Age-parent	42.14	6.80	Percentage of secondary education level	37.56	8.23
Household level			Percentage of high education level	34.81	15.33
Length of residence in the neighborhood	8.81	6.50	Average standardized household income (×1000 euros)	28.77	6.32
Physical			Dependent variable		
environment					
Distance to park	0.39	0.35	Parental perception of child		9.65
Distance to playground	0.25	0.21	friendliness		2.02

Table 3. Sample characteristics

Bivariate analyses (Table 4) show that the perception of child friendliness is significantly higher among male parents, parents with high education, parents with high household income and those living in single family dwellings and living in medium density (suburban) areas. The percentage of roads with separate cycleways is significantly correlated with parental perception of child friendliness. Among the social environmental scales, social cohesion, theft, violence and sexual offenses, average standardized household income of neighborhood, percentage of 0-15 years olds, percentage of over 65 years olds and percentage of high education level people of neighborhood show a significant correlation with parental perception of child friendliness.

		Parental perception of child friendliness					
Variables			Mean	t/F/r	P- value		
Personal level	Gender-parent	Male Female	56.22 53.61	2.455	0.015		
	Education level	Low and secondary education High education	52.04 56.49	7.150	0.000		
Household level	Household income	Below and around the average (+/- € 2000) Above the average	53.37 57.05	2.838	0.001		
	Dwelling type	Apartment House (single family dwelling)	51.63 55.39	0.903	0.004		
Physical environment Social environment	Urban density	Very high urban density High/ Middle/ Low urban density Very low urban density	53.21 56.19 49.17	5.042	0.007		
	Percentage of roads with separate cycleways			0.124	0.023		
	Social cohesion Theft			0.461 -0.142	0.000 0.009		
	Violence and sexual offenses			-0.141	0.010		
	Average standardized household income of neighborhood (x 1,000			0.128	0.018		
	Percentage of 0-15 years olds			0.184	0.001		
	Percentage of over 65 years olds			-0.126	0.020		
	Percentage of high education level			0.111	0.041		

 Table 4. Associations between parental perception of child friendliness and independent variables (only including variables with p>0.05)

The first regression model (Table 5), containing only personal variables (parent's gender and education level) as explanatory variables has an adjusted R^2 value of 0.049. It implies that personal variables explained only 4.9% of the variance in parental perception of child friendliness. In the second model obtained by adding household variables, the adjusted R^2 is 0.072, which is only a small increase of fit over the first model. The third model where physical environment variables has been added, has a model fit of adjusted R^2 =0.098. The fourth model (R^2 =0.273) shows a substantial improvement over the third model by adding social environment variables. In comparing the increase of the adjusted R^2 values after adding variables, the social environment as perceived by the parents plays an important role in explaining parental perception of child friendliness. In the final model, being female (β = -1.89, p < 0.05), parent's high education (β = 2.35, p < 0.05), the percentage of roads with separate cycleways (β = 0.12, p < 0.001), social cohesion (β = 1.62, p < 0.001) and the percentage of 0-15 years old children in the neighborhood (β = 0.28, p < 0.001) are found to be significantly associated with parental perception of child friendliness. Figure 1 shows the results of final model graphically.

	Model 1	Model 2	Model 3	Model 4
Constant	52.04***	54.37***	47.32***	22.04***
Constant	(S.E.=0.80)	(S.E.=1.13)	(S.E.=2.20)	(S.E.=3.48)
Female		-2.17**		-1.89**
remate		(S.E.=1.05)		(S.E.=0.93)
High adjugation level	4.45***	3.82***	4.26***	2.35**
Tigh education level	(S.E.=1.04)	(S.E.=1.05)	(S.E.=1.02)	(S.E.=0.94)
Apartmont		-3.28**	-2.95**	
Apartment		(S.E.=1.28)	(S.E.=1.34)	
Very high urban density			-2.63**	
very high urban density			(S.E.=1.05)	
Percentage of roads with			0.16***	0.12***
separate cycleways			(S.E.=0.05)	(S.E.=0.04)
Social achasion				1.62***
Social conesion				(S.E.=0.18)
Parcontago of 0, 15 years olds				0.28***
reicentage of 0-15 years olds				(S.E.=0.09)
5 ²				
R ²	0.052	0.080	0.109	0.283
Adjusted R ²	0.049	0.072	0.098	0.273

Table 5. Multiple linear regression analyses on parental perception of child friendliness

* Significant at 0.10 level.

** Significant at 0.05 level.

*** Significant at 0.01 level.



Figure 1. Diagram of the result of final regression analyses on parental perception of child friendliness **DISCUSSION**

In the final regression model, personal factors such as a parent's gender and educational level have a relationship with the person's perception of child friendliness. Keeping all else equal, female's perception of child friendliness is lower than male's perception. This result is in line with the earlier finding that female parents perceive the road environment as more dangerous than male parents.³⁹ This may reflect a tendency that women are generally more cautious than men.⁴⁰ Moreover, women spend more time supervising their children than men.⁴¹ Keeping everything else equal, parents with high education on average have higher perception of child friendliness compared to those with lower education. This result is in line with previous studies which found that children are more likely to be granted more independence when their parents have higher levels of education.⁴² For physical environment characteristics, the percentage of roads with separate cycleways is positively associated with parental perception of child friendliness. This may be because roads with separate cycleways are perceived as safer. This outcome is in line with previous studies which indicated that increasing separated cycleways could increase children's active school travel.⁴³ It is also found that children are more likely to cycle when there are more cycleways.⁴⁴ This seems contrary with the finding that children who live in neighborhoods with lower cycle lane availability have higher independent mobility in New Zealand. However, this is explained due to parents allowing their children to walk independently rather than cycling.⁴⁵ Compared with New Zealand, the roads in the Netherlands are generally more suitable for children to cycle by design. Therefore, Dutch parents may give their children more independency about cycling.

For social environment characteristics, social cohesion has a significant positive relationship with parental perceptions of child friendliness. This result is consistent with the finding that there is a positive relationship between perceived safety and social cohesion.⁴⁶ This is also in line with findings that having connections in the neighborhood is positively associated with parental perceived safety.⁴⁷ It has also been found that parents who perceived greater social cohesion are more likely to grant their children greater independent mobility.⁴⁸ The percentage of 0-15 years old children in the neighborhood also has a positive relationship with perception of child friendliness. This result is in line with the finding that an increase of access to friends could improve children's independent mobility.⁴⁹ What's more, children have a basic need to meet peer friends and play with them. Having peers in the neighborhood is also one of the core dimensions of a framework to measure child friendliness of a neighborhood environment.⁵⁰

Although the results offer useful insights, the present study has also some limitations that must be mentioned. First, this study focused on the Dutch context. It is not sure whether the findings are generalizable to other countries. Second, the survey data was collected in the summer. Respondents may have different feelings about their neighborhoods in different seasons. In future research we will also focus on whether parental perceptions of child friendliness influence children's physical activity.

CONCLUSION

This study considered parental perception of child friendliness in neighborhoods and provided a method to measure parental perception of child friendliness based on a survey. The measurement method as applied in an on-line survey using a national sample. To explain parents' perceptions, a wide range of variables were used including socio-economic characteristics of the household, the residential situation and social environment that may influence the perception of child friendliness. Complementary objective physical neighborhood data were obtained by using GIS and CBS. The results indicate that parental perceptions of child friendliness are related to the parent's gender and educational level. The percentage of roads with separate cycleways, the percentage of 0-15 years olds and social cohesion have positive relationships with parental perception of child friendliness.

Therefore, policy makers should increase separate cycleways and promote neighbourhood social cohesion, such as organizing community activities to enhance communication between neighbours and helping them share the same value to create more child friendly neighborhood environments.

NOTES

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INNER GEOGRAPHIES AS AN INTERDISCIPLINARY APPROACH TO INNER WELLBEING: THE PSYCHO-SPATIAL CONNECTION BETWEEN HUMANITY-CENTRED EXPERIENCE AND VALUE-SENSITIVE DESIGN

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INTRODUCTION

The response of architecture to current challenges of social sustainability and health faced by global cities necessitates disruptive thinking that foregrounds 'human-centred experience' and 'value-sensitive design' in the built environment that facilitates flourishing¹ quality of life. For inner wellbeing to be a central purpose of urban resilience² research and design in architectural discipline needs to be positioned within the paradigm of Positive Psychology.

This may be approached through a renewed understanding and application of aesthetics³ – drawing on Alexander Gottlieb Baumgarten's framework of knowledge on perceptive feeling and sensation as well as the artistic/creative/design character of spaces and artefacts. As such, two questions may be posed: What qualities of spaces afford uplifting experiences to city inhabitants? How may we better approach the relation between spatial design and positive psychological health in everyday city life?

This paper explores and describes the (seemingly obvious yet somewhat under-researched) links between emotive experiences and spatial qualities that positively affect inner wellbeing. It draws on my doctoral research on the psycho-spatial phenomenon of the inner geographies, which entailed a theoretical and empirical investigation of individuals' inner-sensory perceptive experiences of their spatial encounters.

The paper argues that the adoption of an interdisciplinary approach to architecture may enable more responsive and responsible ways of creating knowledge and place-making by actively considering the relation between spatial design and psychological affect. This may open up possibilities to develop strategies, tools, and policies for contemporary environments to manifest positive inner wellbeing of individuals and communities in cities.

CURRENT CONTEXT

People-place interactions in cities are changing, particularly in the ways in which spaces are used and perceived. The paradoxical impacts of rapid urbanisation and the pandemic-driven urban 'exodus' have implicated on the quality of life offered by cities and experienced by

inhabitants – heightening focus on the links between socio-emotional behaviour and spatial settings. These marked transformations in present practices of everyday life have illuminated the significance of psychological/mental health and the influence of built environments for positive inner wellbeing.

Quality of life and wellbeing

According to Desmet and Pohlmeyer, the broad concept of wellbeing represents an individual's overall quality of life (i.e. the overall degree to which life is 'good') through two distinct but interrelated aspects: objective and subjective wellbeing⁴. Objective wellbeing is "the degree to which external requirements for having a high quality of life are met."⁵ It is suggestive of quality of life in cities that is often measured in terms of "liveability", which covers provisions of functionality and services categorised by "stability, healthcare, culture and environment, education and infrastructure."⁶

Whilst "'health-related' quality of life"⁷ pertains to wellbeing, it is traditionally "measured in relation to the presence of a disease or medical condition of 'a patient' in comparison to a fully healthy life"⁸. It differs from subjective wellbeing, which represents "a person's personal perceptions or value judgements of quality of life,"⁹ taking into consideration "total wellbeing, whoever experiences it, and for whatever reason."¹⁰ Measured on indicators of "life evaluations, positive emotions, and negative emotions (or positive and negative affect),"¹¹ 'subjective' wellbeing is therefore used synonymously with 'inner' wellbeing in this paper.

Built environments and architecture

Studies and statistics¹² show changes in quality of life rankings, matrices, and indices of global cities – highlighting the intensification of interest in intersections between urban living and inner wellbeing. This is also demonstrated by an increase in research positioned in the field of 'environmental psychology'¹³ and spatial experience situated within the 'creative turn'¹⁴ of the Arts and Humanities as well as Social Sciences.

As part of the rising integration of neurosciences with other fields – of which architecture is one, i.e. neuroarchitecture¹⁵ – the Social Sciences have also called upon architecture to "focus on deeper psychological states."¹⁶ But contemporary uptake by the architectural discipline is limited. Despite disciplinary foundations of genius loci, phenomenology, and psychogeography by prolific theorists (eg. Maurice Merleau-Ponty, Christian Norberg-Schulz, Guy Debord and the Situationists, Kevin Lynch, Yi-Fu Tuan, and Juhani Pallasmaa, among others), there remains scarcity of scholarship¹⁷ into an 'architectural psychology', save for few academic and practical offerings on the 'phenomena of spatial design'¹⁸ and 'architectural atmospheres.'¹⁹ Prevailing architectural research also tends to investigate 'tangible' somatic experience focused on the haptic senses; it appears to not feature predominantly in research of sensorial experience pertaining to the "sense of inwardness", which includes the emotive.

Due to prejudices "concerning subjectivity and interiority of emotions and moods,"²⁰ emotion has been "undertheorized" in architecture until quite recently²¹. Hence, 'emotion' may still be deemed an "odd word to bring into an architectural discussion"²² and there has been "little academic research into the actual emotional effect that places have on people."²³

AN INTERDISCIPLINARY APPROACH

But new initiatives such as the New European Bauhaus (NEB)²⁴ are urging that cities go "beyond building" to focus on designing "enriching experiences" by situating research and design of built environments at the crossroads between art, culture, social inclusion, science and technology. Whilst these concepts are not new to architecture, it draws attention to the 'intangible' qualities of city spaces encountered through the 'implicit sense' of "minds and souls" – making explicit the involvement of architecture in emotive interactions that facilitate inner-wellbeing. It foregrounds the necessity of an interdisciplinary approach to architecture, which is needed for creating socially sustainable and healthy living experiences.

Toward an Architectural Psychology

The active pursuit of an interdisciplinary approach may assist the architectural discipline in considering emotive affect when promoting the "aesthetic value"²⁵ of architectural design. But, for the architectural discipline to go beyond merely "describing relationships between phenomena,"²⁶ it would benefit from developing scholarship in architectural psychology – to investigate and better understand individuals' inner sensory perception of spatial settings for design that facilitates positive inner wellbeing.

Positive Psychology and Capability theory

The burgeoning field of Positive Psychology²⁷ focuses on "what makes life worth living and determining the conditions for human well-being."²⁸ With heightened interest in subjective wellbeing, it makes explicit 'personal values' of "optimism, gratitude, forgiveness, altruism, and hope" as well as techniques that "can improve well-being, such as mindfulness meditation or well-being therapy."²⁹ By considering "the conditions and processes that contribute to human flourishing³⁰", Positive Psychology also shares aspirations of 'capability'³¹ theory. The Capability approach focuses on factors of individuals and those into which daily life is embedded, which together influence the quality of a person's life from an ability-related perspective (rather than on disease and disabilities). In so doing, Positive Psychology and the Capability theory indicate changing priorities from a "materialistic" to "post-material" perspective in support of human flourishing when considering design.

Positive Design

To facilitate long-term quality of life, the contemporary approaches of Positive Psychology and Capability employ Positive Design – "an umbrella term for all forms of design, design research and design intention in which explicit attention is paid to the effects of design on the subjective well-being of individuals and communities."³² It combines underpinnings of Positive Psychology with design theory in a framework, which may be used to "design explicitly for subjective well-being or to research the impact of design on people's happiness."³³ Whilst examples of industrial and product design demonstrate theoretical and methodological aspects, the premise of Positive Design as "driven by the intent to enable human flourishing," may be applied in architectural design.

Sharing space with architecture

Since the built environment is "initially perceived emotionally – that is, prior to our conscious reflection on its many details,"³⁴ in order for architecture to participate in growing a positive design discourse related to inner wellbeing, the discipline needs to converge

"influences from disciplines outside of design."³⁵ Consciously including the Arts and Humanities and Social Sciences in architectural design and research in an interdisciplinary approach may enable the critical interpretation, translation, and application of complementary disciplinary constructs and unlock their combined potential to better understand aesthetics to design for positive inner wellbeing.

This may be achieved by developing an underlying theory and conceptual framework for understanding the complexity of intimate and personal experiences, as well as formulating a methodology that uses creative ways for investigating it, to aid in architectural design that is considerate of these psycho-spatial qualities.

INNER GEOGRAPHIES

My research interest in psycho-spatial experience was sparked by my doctoral research on the phenomenon of the inner geographies³⁶. I employed a GeoHumanities³⁷ approach – which intertwined the Social Sciences and Arts and Humanities with architecture – to qualitatively investigate individuals' inner-sensory perceptive (i.e. emotive and intuitive) encounters with spaces or worlds both without and within the self. The inner geographies has provided the basis for prompting interdisciplinary discussions, gaining insight, and advancing research on the relation between psychological experience and spatial settings to better understand and facilitate positive inner wellbeing.

The phenomenon of the inner geographies

Briefly, the 'inner geographies' is of abstract, (in)tangible, and somewhat elusive nature. Human geographer Inger Birkeland employed the evocative term to formulate her understanding of the self via people-place relations by drawing on Carl Jung's reference to "the totality or ordering principle of a human being's personality,"³⁸ and underpinning that psychological and spatial relations (or the *psycho-spatial*) centres on inner-sensory perceptual experience. Later, psychoanalyst Robert Moore undertook a neo-Jungian approach to discovering and understanding holistic development and spiritual growth via his "map of the inner geography"³⁹.

Developing this premise, my doctoral research suggested that the inner geographies constitutes interconnected essences of awareness, atmospheres, and imagination, which attunes us to what spaces we experience and how we experience them. These essences coalesce with individuals' significant encounters in both tangible and intangible spaces, or worlds, that are experienced both externally and internally through both body and mind – thereby constituting the spirit of place and person. My research indicated that the inner geographies is indeed a psycho-spatial phenomenon that is innate yet omnipotent, which is actively and intimately involved in individuals' everyday 'situated' and 'mindful' life – ultimately affecting individuals' wellbeing.

Methodology

My doctoral study undertook to theoretically and empirically explore and describe individuals' spatial experiences by integrating experiential realms of spatiality and existentialism based on assumptions of phenomenology and metaphysics (philosophy of mind).

Theoretical: triadic leitmotif

The theoretical investigation into inner-sensory perception was founded on a leitmotif of awareness, atmospheres, and imagination inspired by a painting by Giorgio De Chirico and a novel by Sir VS Naipaul – both sharing a similar name, *The Enigma of Arrival*⁴⁰. The framework of these three

essences was situated within a conceptual framework of emotional geographies (which links lived encounters with affective involvements) and practical framework of global mobilities (which is pertinent to socio-spatial temporal conditions). This theoretical grounding underpinned the empirical research – as the strategy to engage a sample group of geo-biographically diverse and mobile global participants in the naturalistic setting of Barcelona, Spain through fieldwork.

Empirical: emotively-orientated sensory methodology

Using the triadic interconnection of awareness, atmospheres, and imagination, I formulated an emotively-orientated sensory methodology by drawing upon, adapting, and combining existing research methods⁴¹ that acknowledged 'other' ways of sensing spaces or worlds. It focused on participants' actual, fantasised, symbolic, and spiritual journeys, which included encounters in spaces in and near Barcelona, beyond the city and around the globe, as well as within themselves. The empirical data revealing individuals' thoughts and feelings was collected using narrative and creative methods via techniques of dialogue, writing, and illustration (eg. graphing, mapping, and drawing) in activities that comprised questionnaires, mind-wandering, and reflection; uncovered data was analysed using interpretative phenomenological analysis (IPA) and narrative and thematic analyses.

Results and Findings

The incorporation of psychological, geographical, and biographical inferences in the methodology enabled the exploration and description as well as the interpretation and understanding of individuals' deeper sensibilities and spatial experiences. The investigation made tangible the 'intangible' phenomena experienced by individuals: it offered access to individuals' explicit and implicit worlds within their everyday lived realities and uncovered hidden emotive and intuitive presences of their inner perceptive experiences. It revealed hidden dimensions, connections, and interactions between individuals and their worlds – as landscapes of feeling comprising innate meanings of experiences in spaces lived without and within the self.

Uplifting experiences

As illustrated in Figure 1⁴², the results showed that: i) individuals' situations are made meaningful through emotive appraisals of 'good' to 'bad' feelings; ii) resonant occurrences comprise place, people, and feelings as singular factors or a combination thereof; and iii) impressionable settings are characterised by socio-spatial landscapes, which include socio-cultural (social and cultural) and physical (built and natural) settings. The analytical interpretation of the results led to a notable finding of thoughts and feelings that were uplifting, thereby having a positive affect on individuals' inner wellbeing. These featured qualities of oneness, integrity, enchantment, serenity, and attunement:

'Oneness' pertained to experiences of totality, wholeness, connection, balance, harmony, and contrasts; 'Integrity' pertained to experiences of authenticity, values, perseverance, and self-actualisation; 'Enchantment' pertained to experiences of allure, captivation, enticement, and retreat; 'Serenity' pertained to experiences of introspection, silence, aura, creativity, liberation, and transformation; and 'Attunement' pertained to experiences of both intimate and broad attentiveness, connections, and resonance within and without the self.



Figure 1. Uplifting thoughts and feelings related to spatial experiences

Model of the inner geographies

The synthesised theoretical and empirical findings resulted in a model of the inner geographies, depicting the integral relationship between a 'way of feeling and knowing' (which is informing, moving, and enriching to individuals' lives through the essences of awareness, atmospheres, and imagination) and a constellation of 'significant encounters' (which are meaningful, resonant, and impressionable everyday experiences in an individuals' lifetime). It indicated that individuals' narratives are composed of and influenced not only by broad exposure to 'outer' spaces, but, importantly, by the deeper interactions with spaces as experienced within the self. This suggests the value of the inner geographies (with its theoretical framework and related methodology) as a possible interdisciplinary and holistic approach that foregrounds the mindful and situated connections in people-place interactions for inner wellbeing.

IMPLICATIONS

A better understanding of psycho-spatial experience through an interdisciplinary approach, such as the inner geographies, offers possibilities to consciously contribute to facilitating positive inner wellbeing. Implicating on the ways in which we consider, interact with, and shape our worlds in everyday contemporary life, it offers an opportunity to further research and develop a renewed approach to architectural design from a perspective that emphasises the psychological experience of individuals.

The place of positive inner wellbeing in architecture

The recommendations of my doctoral study suggested further research to develop contemporary architectural discourse by using the contributions of the inner geographies. To address and respond to the challenges and opportunities of everyday experiences in global cities, interdisciplinary collaboration is needed to inspire new as well as renew existing ways of approaching, engaging with, and creating knowledge and making places (through scholarship and practice in architecture) - as well as generating new questions and further research on facilitating positive inner wellbeing in cities.

The inner geographies can explicitly relate psychological experience and spatial environments by using theoretical and empirical concepts and techniques embedded in the Arts and Humanities as well as Social Sciences. This can prompt existential associations with spatial design that highlight uplifting experiences for the everyday individual engaging with built environments, as well as the coalescence of thinking (critically and analytically) and feeling (intuitively and emotively) for those individuals who are designing spaces. In so doing, the inner geographies can signify and contextualise individual agency in both the experience and design of spatial settings through an acknowledgement and appreciation of personal values - which implicates not only on our individual worlds but also on our shared world. As such, it can refresh disciplinary traditions and conventions of architecture (such as, but not limited to, existing matrices⁴³ of contextual responsiveness, spatial arrangements, formal composition, and technological components) that currently foreground built artefacts and material environs in design processes and analyses. By highlighting the potential of the interconnectedness between material and immaterial worlds in architecture, the inner geographies draws attention to recognising not only the built spaces within which we live, but those psychological spaces which live within us, which together contribute to flourishing quality of life in the built environment.

CONCLUSION

In this paper, I have introduced my explorations and descriptions of aesthetic entanglements between the psychical and physical, intimate and universal, and individuals and environments. Using the phenomenon of the inner geographies and related emotively-orientated methodology, I have attempted to show that it should be possible to develop an interdisciplinary approach that supports researchers and designers in driving humanity-centred experience and value-sensitive design to better understand positive inner wellbeing and the role of built environments in facilitating it.

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NOTES

¹ "People who flourish are developing as individuals, live their lives to their fullest potential, and act in the best interests of society". Pieter M. A. Desmet et al, "Positive Design: An Introduction to Design for Subjective Well-Being", International Journal of Design 7, no. 3 (2013): 5.

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² "World Wellbeing Panel (WWP)," Barcelona School of Economics, accessed December 27, 2021, https://bse.eu/research/world-wellbeing-panel

³ On the twofold interpretation of 'aesthetics', see also Mizan Rambhoros, "Inner Geographies as poetic-aesthetic knowing: the inspiration and manifestation of creative doings through an emotively-orientated sensory methodology" In *Design Culture(s). Cumulus Conference Proceedings Roma 2021*, ed. Loredana Di Lucchio et al. (Cumulus Conference Proceedings Series 7, no. 2, 2021: 865-882).

⁴ Pieter M. A. Desmet et al, "Positive Design: An Introduction to Design for Subjective Well-Being", International Journal of Design 7, no. 3 (2013): 5-19. http://www.ijdesign.org/index.php/IJDesign/article/viewFile/1666/587
 ⁵ Desmet et al, 10.

⁶ "The Global Liveability Index 2019," The Economist Intelligence Unit, accessed March 3, 2021. https://www.eiu.com/Handlers/WhitepaperHandler.ashx?fi=Liveability-Free-report-

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⁹ Desmet et al, 10.

¹⁰ Helliwell et al, 11.

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POST REFORM HEALTH CARE STRUCTURE IN SWEDEN – ARCHITECTURE, ORGANIZATION AND HOW TO GET THERE

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INTRODUCTION

As of 2016, a new way of focusing on the patient and approaching the user of health care services was presented in the Swedish state report "Effective Healthcare" (Effektiv vård).¹ This inquiry marked the start of a nationwide Swedish healthcare reform, a reform focussing what could be called integrated care. A reform aimed at bringing the healthcare system "closer" to the people, i.e. easier and quicker access. The reform not only drives an overarching change within the national healthcare service but also within different organizational levels. The municipal, regional, and national readjustments concerning healthcare are affected by the development of digital techniques and new modes of communication, medical technologies, changing demography, home care etc., aspects that also impacts location and structure of the built environment and facilities used by the healthcare system.

The reform raises the question of how built environment through it's design, can interplay and interact with the reform drivers of changed service delivery, resource efficiency and person-centered care. And, how can this be managed during a worldwide pandemic outbreak, bringing new demands on healthcare delivery and structure.

A study initiated by the real estate organizations of Swedish municipalities and regions through their organization Swedish Municipalities and Regions (SKR) was conducted to explore how the regions in Sweden define and address the changes and initiatives within the integrated care approach. Focus group interviews with representatives from the different regions of Sweden were performed and complemented with survey-information from SKR along with an overview of current information from the web sites of the regions.

METHODS

To conduct the study, primary material was collected through interviews with respondents from the different regions complemented with a survey, along with a secondary material in the form analysis of a previous survey conducted by SKR (Swedish Municipalities and Regions) regarding investments in health care structures. Through triangulation of a purpose specific material (the primary data) and analysis of an already existing data (the secondary data), it was possible to compare the results from the three collections² and catch both the collective and individual experiences of the respondents.³⁴ The sampling of the primary data was a convenience sample out of a contact list provided by SKR and through a scoping of web sites of all the regions, to find contact information to professionals

working with the integrated care approach. Interested representatives were invited to focus group interviews using a digital platform for availability. A total of twenty-one respondents responded positively to the invitation, representing both the facility management and the operational healthcare from eighteen out of the twenty-one regions in Sweden. In total, four focus group interviews along with three individual interviews were completed, with the aim of collecting the collective understanding of the topic.⁵ At least two representatives from CVA (Centre for Healthcare Architecture at Chalmers University, Gothenburg) conducted the interviews to secure validity and take notes using a field protocol. The focus group interview lengths were around ninety minutes long each. Using a digital platform to conduct the interviews came with both pros and cons. first it was very useful in the way of availability; the informants did not have to travel or to block their busy calendars for longer than the duration of the interviews. They also had the comfort of their own, known environment. On the other hand, the digital interview may have negative implications such as affecting the individual informant negatively in the form of not participating in the conversations in the same extent as a physical interview could have. Also, the interaction between informants may have been negatively impacted since the digital room inhibits the participant to fully read interactions and may also create insecurity from lack of control and knowledge of the functions within the digital platform.⁶

A semi-structured interview guide was used with three main themes, guiding the conversations towards discussions regarding; (i) localization, (ii) structure and (iii) implications of the integrated care approach on the built environment through different angels of approach.

Prior to the focus group interviews, a systematic scoping study of the regional web sites was completed to investigate the current situation concerning which and to what extent physical implications on the built environment, as a result of the new healthcare reform, had been addressed. This was done understand the organizational context for the real estate issues coming from the reform. The analyses of both surveys were used to describe *how* the current situation was depicted, through descriptive analysis of frequencies and means of the survey questions.⁷ Analysis of the transcripts from the focus group interviews was done via a deductive content analysis,⁸ with the main purpose of explaining the survey results and to explain *why* the current situation was depicted the way it was.

INITIAL FINDINGS

The regions had different success in implementing the new integrated care approach and around half of them had one or more concrete examples of how they currently worked with questions emanating from the reform. In some ongoing projects, the integrated care approach had been integrated in the development or restructuring of health care facilities, but in others, the reform had only been a topic of discussion being overshadowed by other projects, unspecific directives or a lacking pilot studies and needs' analyses. The proposed effects on the physical environment were even more scarce which was illustrated by one of the informants, who said: "Yesterday was the first time we even discussed the connection between the integrated care approach and healthcare facilities". The survey showed that these types of discussions had mostly been done on the official, strategic, and political levels within the regions and that it mostly handled questions about digitalization and e-health. These discussions did not seem to portray any tangible implications on facility investments nor discussions about physical co-localizations of health care establishments.

Another problematic part of the implementation of the reform is that it was considered a challenge for the regions to work with facility related questions, because there is an uncertainty about what types of healthcare facilities will be needed in the future. "The governmental positioning based on the inquiry called for less amount of future healthcare, which would conclude a lesser need of physical space within the health care facilities. At the same time, it is proposed to increase the check-ups and screenings of patients, which is contradicting" according to one informant. Another informant said that there is a need to work with both a short term- and a long-term approach simultaneously, with compromises in decision making to limit the risks for eventual conflicts of interests.

An analysis of the survey conducted by SKR indicated a state of investment inaction from a lot of regions and was it illustrated by one region that had an undergoing investigation of what this new reform meant for their future investments – putting current actions and investments on hold, acting as a stressor for the region as it had a vast need of renovation of their health care facilities.

Integrated care - a challenge or a possibility?

The reactions about the reform were also dyadic, where almost half of the survey participants viewed the current work with the integrated care approach as challenging, but at the same time positive in the forms of time- and resource effective not only for the health care professionals but also for the users/patients. The survey data indicated that the participants viewing the integrated care approach as a possibility saw a stronger connection between the reform and a health increasing aspect than the ones seeing it as a challenge.

Along with the challenges, the survey also indicated a possible problem with getting the users/patients to apply to the integrated care functions rather than seeking healthcare as usual as well as a challenge in including cooperation with other healthcare functions and related actors. The reform needed to include both outwards- and inwards directives to become fully implemented.

The possibilities with the reform were, among others, an improved integrated health care concept, enabling flexibility and sub sectioning of healthcare specialities. It was hypothesized to include a need for more space, but at the same time make the usage of the space more effective, more flexible and improve staffing conditions from a central standpoint. This also includes a shift within the healthcare professionals understanding from the current, where the usual reaction to change is "new functions equal new rooms".

The consensus was that what was needed for the close care approach to be successful, the regions needed to (1) cooperate both internally and externally in the reformation work, and (2) the cooperation would be facilitated by finding a common definition or an applicable conceptualization of what the concept of integrated care includes.

The importance of health care properties and premises in the future

A great variety among the regions was found regarding the future of healthcare facilities and premises. Most of the regions believed that there will either be an increased need for health care space or an unchanged need in the future. The increased need includes a higher capacity of hospital beds and new types of facilities, for functions such as digital healthcare, or ambulatory care units. Among the regions seeing a decreasing need for healthcare facilities and premises in the future, the scope was on a higher degree of flexibility within the current premises because of a lesser capacity of hospital beds – where a substantial part of today's functions could be relocated to the primary care. Examples of this was simpler operations, mammography, and x-ray examinations. Another part of the arguments for the decreasing need was the implementation of self-assessments and self-treatments under the supervision of healthcare personnel.

The future development and need of healthcare facilities boiled down to three main aspects: firstly, level structuring strategies in the form of decisions about what is supposed to be included in the inpatient care and what is to be outpatient care with the new reform. What type of healthcare needs the resources should be located at hospital level and what can be distributed to the primary care level?

Secondly, future healthcare facilities could also include cooperation, shared and rentable premises enabling better access for the population. The third and last aspect is the inclusion of healthcare personnel and their role in the process of reformation. The integrated care approach is not only a discussion about changes in the physical realm, as addressed in this paper, rather it is about a cultural change for the professionals that has a crucial part in the leveling structure. No structural change would be successful if there are no people available to implement the transformation.

Implementing a reform amidst a pandemic

The overall opinion about the implementation of the integrated care approach was that it had to be put on hold because of the Covid-19 outbreak. However, as the conversations progressed, the informants agreed that the sudden changes and need of a new way to offer proper healthcare during the pandemic led to a quicker implementation of the reform in some regards. A lot of the ongoing investigations about renovations and establishing new healthcare facilities came to a pause. New needs of patient separation and digital healthcare were both examples of changes that directly or indirectly impacted the physical environment that also included new working procedures for the personnel. Being able to work from home or seeing the patient in their own home through digital platforms could both be a part of the integrated care approach – which in prolongation could have implications on the built environment. This could be changes within the administrative areas of the health care facilities, new/more spaces for digital health care etc.

A previous "resistance" of digitalization seems to have been overturned, the pandemic has forced the regional healthcare to adapt and change, turning vague discussions on an overarching level to concrete actions on the floor. The pandemic has brought new ends to meet the accessibility and availability needs. The question then is; will the Swedish healthcare system make these changes into permanent solutions or will it go back to normal in a post pandemic situation? Reverting back to a slower pace of change through investigations, committees and stepwise solutions.

CONCLUSION

In this study, the first conclusion about the reform and its implication on healthcare facilities are that its contents must be more clearly defined, as a form of bordering object. Such an object is necessary when it comes to creating consensus within and outside of an organization about what is to be done and how to achieve collaboration.⁹ The current understanding of the reform is dependent on the different regions, which of course could impose problems for a nation-wide inquiry. The lack of a bordering object not only inhibit collaboration, but also the starting of processes of implementation of the integrated care approach. The findings from this study could be understood as the effects of ambiguity. The pandemic has forced the healthcare system to adapt and adopt parts of the integrated care approach, testing the new work model without prior research and development.¹⁰

The reform is also described as a means to streamline the healthcare through having the correct resources available – both the physical/structural resources and the personnel. The question remains: how will the structuring transact? The focus group interviews pointed towards a divide between the healthcare facility developers and the healthcare personnel, where the former must focus on the future and what changes it brings, while the latter needs prioritize on the "now", current actions in the current situation. It is thereby, we would conclude, of utter importance to initiate dialogues, coordination, and collaboration between the instances to find a way forward *together* through the implementation of the reform.¹¹

Even though the question of the built environment is an important piece of the new reform, all healthcare takes place somewhere, this study has found that concrete examples and guidelines are

scarce, if any. When questions arise in the regions, it is most likely up to them to investigate and interpret what the reform and its physical manifestations actually means for them, individually, rather than having an overall orientation to start from. Since the reform is supposed to bring an increase in access and availability for both individuals and support societal health promoting and preventive measures,¹² appropriate planning and facilities to support these standards is a must.

To conclude, to progress the question of future healthcare facilities, the regions need to decide, or set, the level of collaboration and coordination within the healthcare system, as well as establish guidelines for the integrated care approach. Only then is it possible to determine what type of organization is needed and to understand what to build for. This also needs to derive from the pillars of the reformation work the integrated care approach is based upon. If well structured, the built environment can be both a symbol and an enabler of aspects of the reform.

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