

***Revitalising Urban Spaces to the Needs of the Aging Population - Biophilic Healing Index
Supporting Active Aging in Inclusive Cities***

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Abstract

Due to recent years' involvement in research on behaviours of vulnerable aging people, the author had the opportunity to explore ideas about places and spaces for carers and members of their families living with the condition of dementia by exploring and analysing case studies of interactive spaces in creative neighbourhoods. Investigation of the performance of public open spaces, including streets, piazzas, green and blue infrastructure led to understanding how the built environment and urban space can impact changes in the mood and behaviours of people suffering from mental illnesses and conditions. Hence, the author shared research with students by focusing on the human behaviours of people navigating in urban spaces designed for active aging and human comfort. Students and the tutor have measured Biophilia in urban spaces and promoted the implementation of spatial configurations of human movements via permeable pathlines that increase walkability and free flow. Cognitive patterns of active connectivity have been designed in spaces where navigation of people with mental health conditions should be able to move freely, relax and enjoy the outdoors. Patterns have been carefully selected and discussed with other authors and researchers, such as Nikos Salingaros who has been promoting Biophilic Healing Index (BHI) measurements for a better quality of life for all for several decades. BHI concepts promote free fractal flow that integrates indoors and outdoors in harmonious ways. BHI is being tested as a validated tool to help practitioners and planners to design age-friendly cities, and support communities to recover from recent restrictions.

Keywords: Biophilic Healing Index, Active Aging, Inclusive Cities, Urban Space Revitalisation

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Introduction

This paper describes how the tutor and her students have used recent findings from surveys that were carried out in an area near the university campus at the University of Derby in the UK. This area expands and blends with the university campus and it is filled mainly with housing inhabited by approximately 70% of an aging population, some of them still active at work or in pension. The surveys were carried out during the academic year 2021-2022 under the supervision of the tutor who provided information to the students about biophilic design and especially about the Biophilic Healing Index. The outcome of these surveys gave the students the opportunity to measure existing patterns of biophilia, if any present, and to try to understand where they should be able to suggest changes to achieve higher scores/percentages of certain patterns via innovative ideas included in their projects for the module Project Research and Urban Design in their programme of studies, BA (Hons) Interior Architecture and Venue Design.

For several years, the author had engaged in shared research with other colleagues at the same university during which she came across and got involved with organisations and institutions that were caring out important projects to improve the health and wellbeing of vulnerable aging groups of social housing residents in the care of persons of their own family environment or local volunteers and social workers. The author of this paper presented her findings at a few national and international conferences in recent years (Tracada, 2017) Hence, she shared her findings with her undergraduate and postgraduate students in her lectures and specialist workshops by also inviting important international scholars to participate in them. As the author has been always interested in the livability of cities, she instructed her students to follow principles and practices aiming at making cities livable, sustainable, and resilient; she also introduced her students to UN Sustainable Development Goals (SDGs). The students had to apply theories and practices of biophilia in their projects, and, at the same time, they had to prioritise and showcase a series of urban space interventions so that health and wellbeing should be at the top of their intentions.

The tutor has also taught her students about special international policy papers, such as *Unfolding Dilemmas of Urban Public Spaces* (Ersoy & Yeoman, 2019) which was published by JPI Urban Europe's Agora. This publication contains important case studies, and amongst them, we found important solutions to the reconfiguration of public spaces via nature-based solutions ensuring inclusivity and accessibility for all citizens. According to JPI Urban Europe's Agora, citizens should be actively involved in the planning and design of public spaces, and local scholars and Universities should be in support of their efforts, too.

To summarise our efforts, we shall show you how by using the Biophilic Healing Index, we managed to test and reconfigure spaces and places for all. The main objectives were:

- Research findings were shared by the tutor and students with representatives of the local communities during forums and surveys; the students and the tutor focused on the human behaviours of people navigating in urban spaces designed for active aging and human comfort. Students and tutor have measured Biophilia in urban spaces and promoted the implementation of spatial configurations of human movements via permeable pathlines that increase walkability and free flow.
- Cognitive patterns of active connectivity have been designed in spaces where people with mental health conditions should be able to navigate, move freely, relax and enjoy the outdoors (also connected with comfortably accessible indoors).

- Patterns have been carefully selected and discussed with other authors and researchers, such as Professor Nikos Salingaros who has been promoting Biophilic Healing Index (BHI) measurements for a better quality of life for all for several decades.
- BHI concepts should be the main promoters of free fractal flow that integrates indoors and outdoors in harmonious ways to support all ages and backgrounds.
- BHI is being tested as a validated tool to help practitioners and planners to design age-friendly cities, and support communities to recover from recent restrictions.

The author believes that the principles of biophilia applied to the built environment and the green and blue infrastructure have the power to always change human behaviours. So, we should be able to transform cities easily to become livable and resilient. As livability relates directly to urban design and planning, both social mobility and financial prosperity could be also altered and affected to the best of a planner and a biophilic designer's intentions (Tracada, 2018). The author has always sustained that all livable neighbourhoods should be "*compact, sustainable, diverse, green, healthy, and above all resilient*" (Tracada, 2022) This is the reason why as a tutor, she promoted the implementation of Sustainable Development Goals; that means participatory planning and engagement of local communities could easily transform cities to be accessible now and in the future. Citizens and scholars should always get involved in active decisions of policymaking.

There is a strong long-lasting legacy of the author with international scholars, and especially with the International Society of Biourbanism (ISB); all scholars of this society have based their research on human-centred design, especially on Biophilic Urban Design. Biourbanism's main aim is "*making a healthy city for healthy citizens*" (Caperna, Tracada & Serafini, 2013). So, also the students learned:

How human neurophysiology reacts to the organization and the forms of space, is the first step to producing an undeniably sustainable new design for the 21st century (Caperna, Tracada & Serafini, 2013).

The author's legacy with Nikos Salingaros began with her involvement in the International Society of Biourbanism as a member of the Scientific Committee at first and being an Editor in Chief for the Journal of Biourbanism from 2011 to 2014. Salingaros's theories on urban science, and especially his principles of the urban web blended with the author's theories on the Line Performance Act thesis and consequent presentations. Hence, Salingaros (1998 & 2005) discussed with the author of this paper the way that humans connect amongst them. Salingaros affirmed that all humans can connect not only visually, but also via less obvious connections (Salingaros, 1998 & 2005). Both scholars agree that the human mind establishes a deep connection with any kind of environment by possessing geometrical information from its surroundings. Thus, some angular and pointing forms, as well as grid-iron plans of indoor or outdoor spaces may create more anxiety for vulnerable people, especially the elderly affected by mental health issues, such as people with dementia condition.

So, during a lecture that Salingaros offered to our students in February 2021, he repeated that the main aim of effective and high-quality design projects should be to explore form, components, and substructure to justify theoretical underpinning based upon urban science and theories; to justify that "*a living city depends on an enormous number of paths and connections of people.*" (Salingaros, 1998 & 2005, 2019 & 2020) Both Nikos Salingaros and the author have taught the students how they should be able to use the Biophilic Healing Index to measure percentages of existing or non-existing patterns (0%) (Salingaros 2019 &

2020) that means that all designers should be able to carry out computing of the Biophilic Healing Index (BHI); Salingeros agreed to propose the following as the main handout for the students as shown in Figure 1. By using this main table of patterns, the students should be also able to create appropriate questions to ask the users of the spaces under investigation and revitalisation, and possibly give a score from 0 to 2 per each pattern. In the case of spaces and places used by vulnerable elderly, their carers and/or family members could do an estimate.

Nikos A. Salingeros at our annual guest lecture for our students on 22nd February 2021:

"We can quantify Biophilia through the Biophilic Healing Index. This gives a percentage score evaluation of how biophilic a design actually is, which combines estimates for ten separate biophilic qualities."

Estimate ten geometrical plus natural qualities listed below according to the scale: 0 = none, 1 = some, 2 = a lot:

- B1. **Sunlight:** preferably from several directions.
- B2. **Colour:** variety and combinations of hues.
- B3. **Gravity:** balance and equilibrium about the vertical axis.
- B4. **Fractals:** things occurring on nested scales.
- B5. **Curves:** on small, medium, and large scales.
- B6. **Detail:** meant to attract the eye.
- B7. **Water:** to be both heard and seen.
- B8. **Life:** living plants, animals, and other people.
- B9. **Representations-of-nature:** naturalistic ornament, realistic paintings, reliefs, and figurative sculptures — including face-like structures.
- B10. **Organized-complexity:** intricate yet coherent designs — and extends to symmetries of abstract face-like structures.

Sum the values for the above biophilic components to define the index B as a number out of 20. For B as a percentage score, simply multiply this total by 5. A quantitative measure of the degree that a design is biophilic is more useful than the usual vague discussions based on images showing potted plants. The more biophilic it measures on this scale, the more a building will contribute positively to the users' health." **WE ARE USING THE INDEX FOR STREETSCAPES AND PIAZZAS & BUILDINGS (INDOORS & OUTDOORS).**

Figure 1: The Biophilic Healing Index as agreed by Nikos Salingeros and the author for the Annual Lecture in February 2021

Measuring Biophilia, and checking indoors and outdoors affordances

In their projects for the module of Project Research and Urban Design in 2021 and 2022, the students were also allowed to start using more than the ten patterns prescribed in Figure 1 above. The reason for this was that initially, they had to explore some suburban areas of the City of Derby in which we had carried out surveys a previous couple of years, and we found a lot of problems with accessibility and mobility in the urban spaces for people with mental health issues (a high percentage of elderly people in need of social care). As the area of interest in 2021 and 2022 has been our campus and the city, then, the students focused on patterns that were easily detected by residents of the areas of interest.

So, the top patterns to explore and get answers to specific questions have been:

- Visual connection with Nature, such as connections with vegetation, animals and insects, natural flowing body of water

- Non-visual connection that deals with ventilation, tactile information such as textured materials, and fragrant plants' smells.
- Presence of water, such as brooks, ponds, fountains, and waterfalls.
- Thermal comfort that deals with solar heat gain, shadow, and shade, radiant surface materials.

The following is an example of a table created by one of the students to check the health and wellbeing of citizens, and to measure BHI in streetscapes in an area that surrounds a green park (See Figure 2). The table does not show percentages for the patterns selected; it shows only scoring from 0 (absence) to 2 (high presence).

Attribute	Level of Presence	Notes
Presence of Biodiversity	2	Trees, varied shrubbery, forbs and grass present
Presence of Organised Complexity	2	Inherent organised complexity of the diverse planting incorporated, details of bordering and spatial organisation of beds
Presence of Fractal Geometry	1	Presence of trees (both within spaces and linearly lining the circulation spaces), geometry of planting beds used to incorporate scales of geometry into green spaces
Presence of Vegetation	2	Varied and diverse planting
Presence of Animals or Fossils	1	Birds (viable and audible) and insects
Preferred Views & Vistas (Savana Analogue)	1	Grass combined with shrubbery and trees, however no water, and some trees are isolated rather than copses and proliferation of hard landscape bisecting spaces mitigated the presence
Representations of Nature	0	None present
Presence of Curves	0	None present
Presence of Water	0	None present
Coherent Combinations and Variety of Colour	2	Plants of varying hues, both between plants and within individual plants, most paving with earth tones and hues with varying intensity of hues within it
Opportunity for Sustained Visual Connection	2	Looked upon by communal spaces of new and refurbished blocks of flats, located adjacent to main circulation spaces

Table 4.6: Analysis of biophilic attributes of public space green corridor.

Figure 2: Sample of student survey by using BHI patterns

Here are some samples of proposed solutions by the students who had discussions with residents at the Arboretum ward in Derby in 2020-2021. Figures 3 – 5 show the transformation of a disused car park area in front of a primary school entrance; the car park used to be the school courtyard. But being close to the Arboretum Park area meant that this courtyard was becoming an area for criminality during the night. The Park started being transformed slowly after the end of Covid-19 restrictions, but at night it was known for criminal activities. The courtyard is reached by an alley on one side of the school. It lacked light at night, and it was dark during the day, too, due to its dark tarmacked surface. The team of students measured the BHI of that space; it scored only 15% for biophilia. With the proposed scheme presented to the local community, the BHI reached 85-90% of biophilia.



Figure 3: The *Secret Garden*

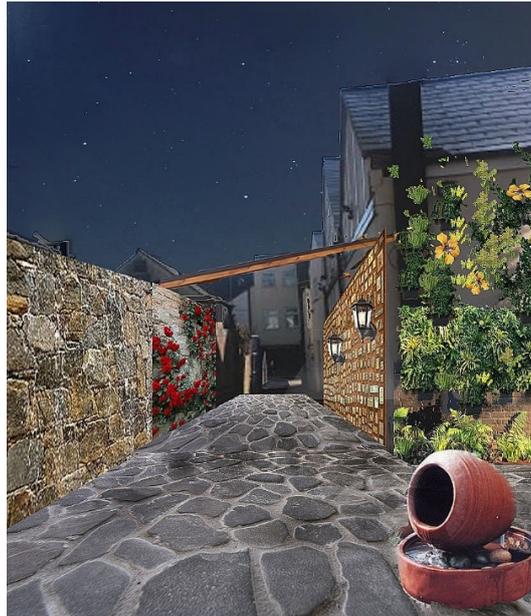


Figure 4: The *Back Alley to the Secret Garden* at Arboretum



Figure 5: Indoor Outdoor Café at the Secret Garden

In the following sample of student work, we can see some important changes proposed to some areas in decline in the centre of Derby. Although Derby is close to the famous Heritage area of the Peak District, it does not show that important connection with nature, and most importantly it does not motivate people to walk or cycle. Cycling routes are dangerously mixed with speedy or jammed car traffic, day, and night. The centre of the city is not used a lot at night, too. The students found that central piazzas as the one by the Town Hall and some cultural areas are barely attractive to people. Especially elderly people find it very difficult to even go for a 15-minute walk around the city. The streets are highly polluted in the day, and unsafe to navigate at night; our campus area suffers from dark and unsafe spots to navigate at night as well. Another issue is that green and blue infrastructure does not reach fully the central area of Derby; there is an evident lack of an attractive Green Way for the people, but also for biodiversity as a green connection corridor amongst green parks and Derwent River. In fact, a brook that connects Markeaton Park to our campus hides underground after flood protection works were carried out some decade ago. Ruth Stephenson-Payne, one of our students who graduated in 2020-2021, not only proposed to

bring back all water sources to the surface but also the Peak District into the city. (See Figures 6 & 7 below).

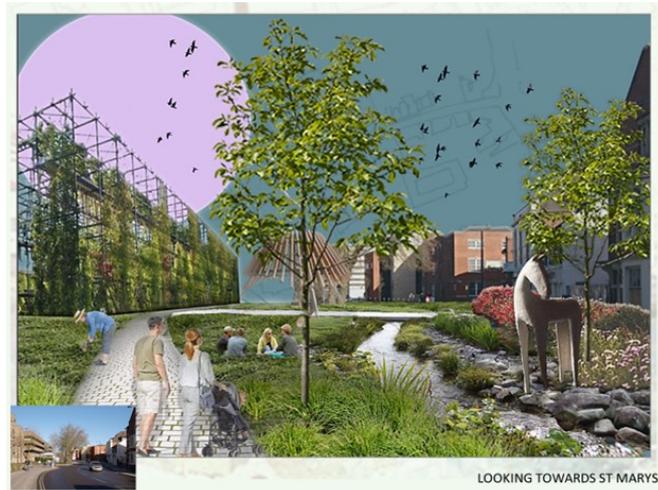


Figure 6: Bringing back the river through the city © Ruth Stephenson-Payne, 2020-2021



Figure 7: Bring the river around important buildings © Ruth Stephenson-Payne, 2020-2021

Finally, the area of our interest in 2021-2022 for Project Research and Urban Design has been our Campus and the surrounding residential and commercial areas. Once again, the students re-discovered the water courses; they lifted all barriers created by railings and enclosures. Their main thought after restrictions was to show their work to all locals, and especially the elderly and the very young. They declared that they want their studios always to be open to all. So, Gary Dawson, another student who graduated recently based his project by computing the Biophilic Healing Index of our Markeaton campus urban area reaching 35% of biophilia. Gary discovered that the railings along the main paths create a feeling of discontent with a dull pathway to our building and no outdoor seating. The water is present but not accessible, and the greenery is present but oppressive. See Figure 8 for the BHI percentage as exists below, and Figures 9 & 10 for changes to get urban affordances for all:

Zone Measured: Markeaton Walkway	
Category	Score 0-2
B1. Sunlight: preferably from several directions.	1
B2. Colour: variety and combination of hues.	0
B3. Gravity: balance and equilibrium about the	2
B4. Fractals: things occurring on nested scales.	1
B5. Curves: on small, medium, and large scales.	0
B6. Detail: meant to attract the eye.	0
B7. Water: to be both heard and seen.	1
B8. Life: living plants, animals, and other people.	2
B9. Representations-of-nature: naturalistic ornament, realistic paintings, reliefs, and figurative sculptures — including face-like structures.	0
B10. Organized-complexity: intricate yet coherent designs — and extends to symmetries	0
Total out of 20	7
Score as a Percentage	35

Figure 8: Calculation of biophilia along Markeaton Walkway © Gary Dawson, 2021-2022



Figure 9: Removal of barriers and dark tarmac along Markeaton Walkway
© Gary Dawson, 2021-2022



Figure 10: Removal of barriers and safety lights along Markeaton Walkway
© Gary Dawson, 2021-2022

Some more examples from student work for Project Research and Urban Design also show how students managed to propose changes according to the increase of some specific biophilic patterns, such as light, colour, detail, connections with nature and the arts, free flowing mobility for all. See the following Figures 11-14:



Figure 11: Connections between art and nature © Aneesa Ahmed, 2021-2022



Figure 12: Health active corridor at Markeaton and Britannia Mill Campus
© Holly Ann Malia, 2021-2022



Figure 13: The Markeaton Campus Sponge Park © Tang Zi Kieng, 2021-2022



Figure 14: The Markeaton Campus blending with the local community
© Amen Feresenbet, 2021-2022

Conclusion

In conclusion, the tutor and students managed to share research activities and get feedback from an international audience at various conferences recently. Currently, the author is working with international colleagues on a specific framework in which the Biophilic Healing Index makes an important component in it. We are currently exploring Active-Health-Oriented Behaviour Design via a Building and Urban Spaces Ratings Matrix; our main aim will be to get more professionals, educators, and students involved in discussions to explore opportunities for creating a “more inclusive built environment to support people’s self-directed behaviors for healthy living” (Tracada, Sorensen Allacci, Aleti, 2022), and especially helping mobility for all.

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