# 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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# ENERGY JUSTICE, INDOOR AIR QUALITY, AND COMMUNITY RESILIENCE AGAINST COVID-19 PANDEMIC

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## INTRODUCTION

Cities account for up to 76% of primary energy consumption[1], contributing to GHG emissions and concentrations of ambient air pollutants. Air pollution is one of the most substantial causes of human-health risks worldwide[2]. Specifically, exposure to particulate matters lesser or equal to 2.5 nm in aerodynamic diameter or $PM_{2.5}$ is a key contributor to the adverse health risks and human life expectancy, resulting in an estimated 8.9 million premature death worldwide in 2015[3]. Most recently, research studies further reveal that spread of the SARS-Cov2 viruses may link to the concentrations of airborne particles that can contain and act as a carrier of the virus[4]. Cities need to better comprehend local $PM_{2.5}$ dynamics and adjust their energy policies through energy reduction strategies such as the application of natural ventilation not compromising occupant health, particularly in vulnerable and at-risk communities.

According to the National Association for the Advancement of Colored People (NAACP)[5], residents that live within three miles of a coal power-plant in the U.S. had an average income of $3k less than the nationwide average. In addition, people of color make up 56% of the population that lives in neighborhoods near facilities on the Toxic Release Inventory (TRI) compared to 30% everywhere else[6]. In contrast, low-income households spend three times as much of their income on energy than others, despite consuming less energy[7]. Since its initiation, Environmental Justice has been striving to develop strategies to lessen environmental discrimination of minority communities[8]. Environmental justice refers to the fair distribution of hardships and advantages caused by the environment[9]. By now, many laws and standards have been set worldwide to prohibit environmental inequities across urban zones.

The idea of energy justice or achieving equity for those who are disproportionately burdened by the energy system has tributed from the environmental justice. Energy justice primarily focuses on the concerns of underprivileged communities to increase the accessibility of affordable and clean energy. A research study by Bouzarovski and Simcock[10] apply a spatial lens to the issue of energy poverty, suggesting that a significant component of domestic energy inequity is geographic disparities. In another study[11], the relationship between residential heating energy use intensity (EUI) and socioeconomic block characteristics such as race and ethnicity in Kansas City, Missouri, is explored. The results suggest that Black and Hispanic households averaged less energy efficient than equal counterparts and showed an increased fuel poverty level. In another study, Agbim et al.[12] evaluate

various drivers of energy injustice by exploring the variation of energy-burdened populations at a regional level while addressing the validity of the current United States energy expenditure metric, indicating that about 53% of energy-burdened individuals become stressed due to their electricity bills.

Natural ventilation as one of the design solutions has the potential to reduce building ventilation and cooling energy loads in cities[13]. According to the International Energy Agency (IEA), if cooling dynamics are not becoming clarified, energy demand from building mechanical systems will be tripled by 2050. To date, existing studies primarily rely on ambient weather and thermal comfort factors as representative of environmental determinates for estimating potentials of natural ventilation for a building in the early-stage design (e.g.,[14]). Air pollution as another determinant is also integrated into the assessment workflows in less granular (e.g.,[15]) and more granular scales[16] in cities. Socioeconomic and community health-resilience contexts, however, are not investigated in exploring natural ventilation throughout urban districts. Currently, with increasing data availability at higher granularity open-data initiatives adopted by many cities, emerging smart cities and advanced sensing technologies, data-driven frameworks and methodologies are a change of paradigm on how interconnected issues within built environments can thoroughly be explored and understood

Therefore, this research aims to explore synergies between social, health, and environmental contexts for early-stage natural ventilation-design, considering energy burdens of households, health resilience, and exposure to ambient PM2.5 concentrations. This study is innovative in bridging these trio contextual aspects of urban building design aims to be operated by natural ventilation. The proposed framework and findings of this study can aid urban planners, policymakers, and health authorities to better understand the dynamics of public health and the energy poverty of households, for reducing cooling goals of sustainable cities. It further supports engineers and designers to explore various possibilities in proposing low-carbon building opportunities for at-risk and vulnerable communities across districts in cities.

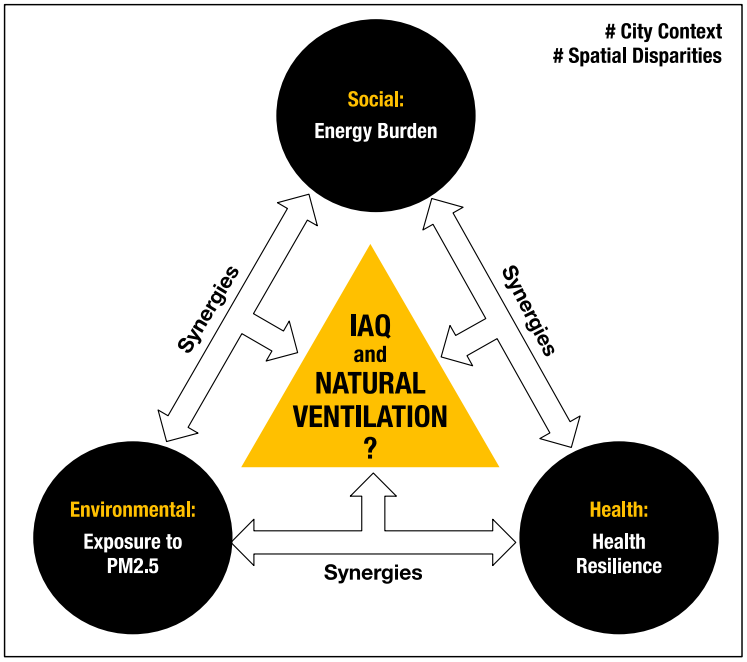


*Figure 1. Diagram of contextual forces and synergies between them for evaluating early-stage natural ventilation potentials with healthy IAQ from social lenses*

## METHODOLOGY

This research employs data-driven methodology to investigate synergies between spatial disparities of social, health, and environmental systems toward low-carbon, healthy, and equitable cities (Figure 1). Chicago was selected as one of the best representative cities in the U.S. demonstrating spatial disparities, inequalities, and segregation[17] across its neighborhoods, and is one of the most ambitious cities in the U.S. that targeted reducing its carbon emissions by 80% in 2050 –compared with the 1990s baseline[18]. Furthermore, Chicago is one of most polluted cities in the U.S. for natural ventilation, the second large city after Los Angeles, CA, with 40% reduced natural ventilation capacity[19]. This research identified the above mentioned three urban contexts using 1) households' energy burden; 2) community health resilience; 3) community exposure to ambient fine particulate pollution ($PM_{2.5}$) as representatives of the trio contextual forces for natural ventilation studies.

### Data

The research identified public datasets for extracting spatial disparities for the trio contextual forces including:

### Spatial Disparities of Community Energy Burden of Households'

In this research, we used the dataset, named *Low-income Energy Affordability Data (LEAD) Too*l [20] provided by the Better Building's Clean Energy to extract Chicago's energy burden disparities at census tract level. In this dataset, the cost of household energy demand is based on averaging the energy burden as a percentage of income spent on energy. Out of three income measure, we used area median income (AMI) because it is specified by local authorities[21]. Therefore, AMI can reveal spatial variations on poverty across urban zones. It binds household income at 5 levels: 0-30%, 30-60%, 60-80%, 80-100%, and 100%.

### Spatial Disparities of Community Health Resilience

We used dataset called *Community Resilience Estimates* (CRE) provided by U.S. Census Bureau for exploring community resilience against disease. This dataset provides measures on how at-risk communities in the country are impacted by COVID-19 and other local disasters, through measuring the capacity of individuals and households in absorbing, enduring and recovering from the impacts of a disaster. CRE dataset is available at national, state, county, and tract levels with geographic identifiers. Out of its three health-risk categories, including zero risk factors, one-two risk factors, and three plus risk factors, we selected the latter category as the health resilience indicator for the study.

### Spatial Disparities of Community Exposure to Ambient PM2.5 Concentrations

We extracted exposure to PM2.5 concentrations data at tract level from the U.S. Centers for Diseases Control and Prevention (CDC)'s data portal for their last update (2016). This dataset provides PM2.5 concentrations at daily intervals (365 days) per tract. For analysis, we followed thresholds defined by the U.S. Environmental Protection Agency (EPA) by which those days that concentration exceeds 12 $\mu gr/m^3$ were only kept and used for analysis. It should be noted that the averaged PM2.5 concentrations equal or lesser that 12 $\mu gr/m^3$ at 24-hr basis is considered "good", and above that, it goes to unhealthy domains. Thus, we used number of days that ambient PM2.5 concentrations exceed the EPA's upper thresholds level, as indicator to study spatial disparities of exposure to the PM2.5 pollutants across Chicago tracts. Figure 2 illustrates zonal boundaries of the city and tracts for Chicago.

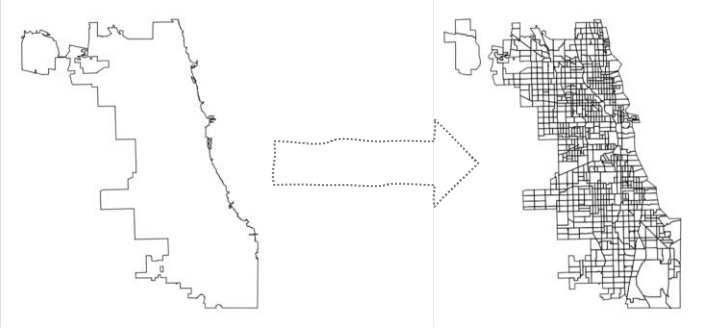


*Figure 2.Chicago city boundary (a) and census tract districts (b)*



## Unraveling interplay between spatial disparities of energy, health resilience, and exposure burdens

In this research, we used spatial disparities of 1) exposure to local $PM_{2.5}$ concentrations as the metric for exploring out-driven IAQ; 2) households' energy burden as the metric for understanding energy justice; and 3) community health resilience as the metric preparedness of communities against pandemics. We calculated Pearson correlation coefficient to calculate relationships between these two-by-two (energy burden vs. health resilience, energy burden vs. exposure, health resilience vs. exposure) using Pearson correlation coefficient (R) equation for capturing relationships between them. Equation 1 and Equation 2 calculates coefficient of determination or R-squared ($R^2$) and Pearson correlation coefficient for performance evaluation of the developed model:

$$R_i^2 = 1 - \frac{\sum_{i=1}^{k}\left(y_{pred,i-} - y_{act,i}\right)^2}{\sum_{i=1}^{k}\left(y_{act,i} - \overline{y}_{act}\right)^2} \quad (1)$$

$$R_i = \sqrt{R_i^2} \quad (2)$$

Where $R_i^2$ indicates the coefficient of determination, $y_{act,i}$ and $y_{pred,i}$ denote the actual and predicted dependent variable for $i^{th}$ observation, $\overline{y}_{act}$ denotes the mean value of the dependent variable, $k$ represents the total number of observations, and $R_i$ stands for Pearson correlation.

## RESULTS AND DISCUSSION

This research unraveled relationships between exposure, energy, and health resilience disparities for exploring buildings' natural ventilation context in Chicago. We used Pearson correlation between each pair of these contextual forces to capture the relationships (Table 1). Results suggest that the number of days with exposure to PM2.5 concentrations above 12 $\mu gr/m^3$ and energy burden of households in Chicago are positively correlated with R=95%, illustrating that households whose annul energy burden is higher they live in urban areas with higher exposure to the pollution, meaning that if they tend to rely on natural ventilation for reducing the cooling/ventilation energy demand in thermally suitable seasons, their chance is lower than those people who live elsewhere in the same city due to higher exposure to the ambient pollution. And accordingly, in case of any distance-working due to pandemics, people with higher energy burden should spend more money on maintaining healthiness of the indoor air quality through mechanical systems. Most recently, studies

indicate that energy injustice is correlated to health risks in cities primarily revealed under the COVID-19 pandemic (e.g.,[22]). This shows the importance of energy access to maintain human health [23], and the results of this research unravel that reducing cooling energy demand is less possible to low-income households in Chicago.

| NO. | Factor | R |
|---|---|---|
| 1 | Spatial Disparities of Number of days with Exposure to PM2.5 concentrations >12 µgr/m3 | 95% |
| | Spatial Disparities of Energy Burden of Households | |
| | | |
| 2 | Spatial Disparities of Number of days with Exposure to PM2.5 concentrations >12 µgr/m3 | 58% |
| | Spatial Disparities of Community Health Resilience | |
| | | |
| 3 | Spatial Disparities of Community Health Resilience | 86% |
| | Spatial Disparities of Energy Burden of Households | |

*Table 1. Pearson correlation (R) between each pair of variables*

Furthermore, this research found that there exists a high positive correlation (R=58%) between number of days with exposure to PM2.5 concentrations above 12 $\mu gr/m^3$ and community health resilience. This indicates that in communities whose residents have lesser resiliency against pandemics based on their health status, if they use NATURAL VENTILATION for building cooling/ventilation, they will be in risks as their capacity to absorb and cope with the disturbance is already lower. In addition, a strong correlation (R=86%) between spatial disparities of community health resilience and spatial disparities of energy burden of households reveals that households whose health resilience capacity is lower, they need to pay more for building cooling/ventilation using mechanical systems than households with higher health resilience capacities. This illustrates inequities embedded in Chicago is access to ambient fresh air in buildings. Figure 3 depicts patterns for all the three contextual forces for natural ventilation within city of Chicago, illustrating similar variations across tracts, with higher densities extended from the north-west through south-east of the city.

The current research can support a concept proposed by Spataru et al.[24], suggesting that envisioning for an integrated low-carbon and affordability approach is of primary importance in climate change mitigations. Drehobl and Ross[25] state that Chicago is one of major cities in the U.S. involves in spatial disparities of energy and health, proposing that by providing energy efficacy for housing up to median household, 35% of energy burden can be reduced. Although it is well proven that natural ventilation as a passive building cooling strategy has the potentials to maintain indoor air quality and at the same time lower cooling and ventilation demand and related energy burdens, to date, existing studies mostly rely on thermodynamics of estimating energy saving potentials of natural ventilation. For example, a study[26] estimate 11.80% annual energy saving potentials for Chicago using natural ventilation, based on weather determinants from an individual point location in a city. Most recently, a study[27] incorporates air pollution into this workflow to estimate energy loss for natural ventilation, in which the supplied data relied only on couple of point locations within urban areas, dismissing spatial variations of contextual forces across zones. The current study can provide a more reliable energy-health-resilience-equity assessment workflow by providing more granular spatial data for the assessment. Most recently, an institutional study in the U.S.[28] reports that there exist synergies between energy burden and health disparities in American cities, aiming to combine energy, health, and housing funding for future energy burden acts. This research can be applied for all cities in the country to explore such capacities and more (public health aspects) for future sustainable cities.

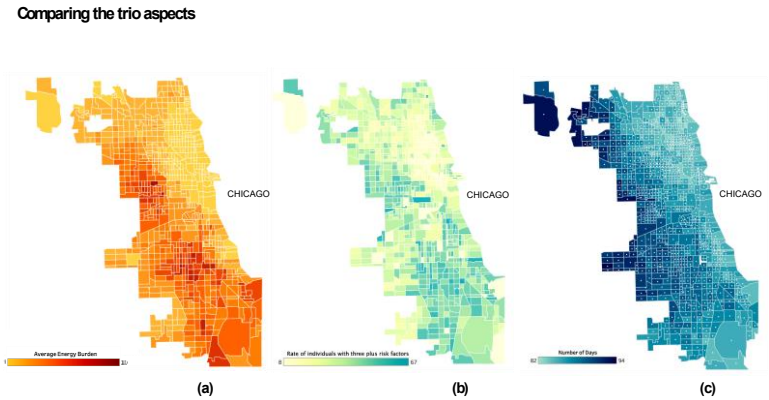


*Figure 3. Maps of spatial disparities of households' energy burden (a), health resilience (b), and number of days with exposure to ambient PM2.5 above EPA standard ( ≥12 μg/m$^3$) (c) in Chicago*

## CONCLUSION

This research unraveled interactions between energy, health, resilience, and equity in built environments focusing on the natural ventilation as the building characteristic that needs to be understand from various perspectives, from social to health and more. As a novel approach, it integrates environmental and energy justices and incorporate them for exploring energy-efficiency strategies such as natural ventilation to support combined climate change and health risks mitigation goals in cities. The results showed that energy, health, and resiliency, and equity are interwoven aspects in Chicago, IL. The findings of this research demonstrated that the proposed research could interconnect a vast pool of urban dynamics for understanding exposure to ambient $PM_{2.5}$ concentrations and energy and justice systems. This framework has the potential to assist policymakers, planners, architects, and engineers in understanding synergies between complex urban systems through building stock to support future sustainable cities.

## NOTES

[1]Edenhofer, Ottmar, Ramon Pichs-Madruga, Youba Sokona, Jan C. Minx, Ellie Farahani, Susanne Kadner, Kristin Seyboth, eds. *Climate Change 2014: Mitigation of Climate Change ; Summary for Policymakers Technical Summary ; Part of the Working Group III Contribution to the Fifth Asessment Report of the Intergovernmental Panel on Climate Change. Geneva*, (Switzerland: Intergovernmental Panel on Climate Change, 2015).

[2] Greenston, Michael, and Claire Qing Fan. "Introducing the Air Quality Life Index: Twelve Facts about Particulate Air Pollution, Human Health, and Global Policy." Energy Policy Institute at the University of Chicago, (November 2018). https://aqli.epic.uchicago.edu/wp-content/uploads/2018/11/AQLI-Report.111918-2.pdf.

[3] Burnett, Richard, Hong Chen, Mieczysław Szyszkowicz, Neal Fann, Bryan Hubbell, C. Arden Pope, Joshua S. Apte. "Global Estimates of Mortality Associated with Long-Term Exposure to Outdoor Fine Particulate Matter." Proceedings of the National Academy of Sciences 115, no. 38 (September 18, 2018): 9592–97. https://doi.org/10.1073/pnas.1803222115.

[4] Setti, Leonardo, Fabrizio Passarini, Gianluigi De Gennaro, Pierluigi Barbieri, Maria Grazia Perrone, Andrea Piazzalunga, Massimo Borelli. "Evaluation of the Potential Relationship between Particulate Matter (PM) Pollution and COVID-19 Infection Spread in Italy",University of Bologna, Italy; University of Bari, Italy; University of Milano, Italy; University of Trieste, Italy; - Italian Society of Environmental Medicine, 2020.; Setti et al., "The Potential Role of Particulate Matter in the Spreading of COVID-19 in Northern Italy"; "Center for Disease Control and Prevention.", University of Bologna, Italy; University of Bari, Italy; University of Milano, Italy; University of Trieste, Italy; - Italian Society of Environmental Medicine, 2020.

[5] Wilson, Adrian, Jacqueline Patterson, Kimberly Wasserman, Amanda Starbuck, Annie Sartor, Judy Hatcher, John Fleming, and Katie Fink, "Coal Blooded: Putting Profits Before People.", Energy Policy 129 (June 2019): 710–37. https://doi.org/10.1016/j.enpol.2019.01.054.

[6] Bullard, Robert D., Paul Mohai, Robin Saha, and Beverly Wright, "Toxic Wastes and Race at Twenty.", Environmental Law 38, no. 2 (2008): 371–411.

[7] Bednar and Reames, "Recognition of and Response to Energy Poverty in the United States.", Nature Energy 5, no. 6 (June 2020): 432–39. https://doi.org/10.1038/s41560-020-0582-0.

[8]Johnson P E, "Two Steps Forward on Environmental Justice.", Environmental Health Perspectives 102, no. 10 (October 1, 1994): 836–38. https://doi.org/10.1289/ehp.94102836.

[9] Schlosberg, *Defining Environmental Justice*. (Oxford University Press, 2009)

[10] Bouzarovski and Simcock, "Spatializing Energy Justice." Energy Policy 107 (August 1, 2017): 640–48. https://doi.org/10.1016/j.enpol.2017.03.064.

[11] Reames, "Targeting Energy Justice." Energy Policy 97 (October 1, 2016): 549–58. https://doi.org/10.1016/j.enpol.2016.07.048.

[12] Agbim, Chinelo, Felipe Araya, Kasey M. Faust, and Dana Harmon, "Subjective versus Objective Energy Burden.", Energy Policy 144 (September 1, 2020): 111616. https://doi.org/10.1016/j.enpol.2020.111616.

[13] Bienvenido-Huertas, Sánchez-García, and Rubio-Bellido, "Analysing Natural Ventilation to Reduce the Cooling Energy Consumption and the Fuel Poverty of Social Dwellings in Coastal Zones.",

[14] Chen, Augenbroe, and Song, "Evaluating the Potential of Hybrid Ventilation for Small to Medium Sized Office Buildings with Different Intelligent Controls and Uncertainties in US Climates," Energy and Buildings 158 (January 2018): 1648–61. https://doi.org/10.1016/j.enbuild.2017.12.004..

[15] Ben-David and Waring, "Impact of Natural versus Mechanical Ventilation on Simulated Indoor Air Quality and Energy Consumption in Offices in Fourteen U.S. Cities"; Building and Environment 104 (August 2016): 320–36. https://doi.org/10.1016/j.buildenv.2016.05.007, Tong et al., "Energy Saving Potential of Natural Ventilation in China.", Applied Energy 179 (October 2016): 660–68. https://doi.org/10.1016/j.apenergy.2016.07.019.

[16] Ashayeri and Abbasabadi, "A Framework for Integrated Energy and Exposure to Ambient Pollution (IEnEx) Assessment toward Low-Carbon, Healthy, and Equitable Cities.", Sustainable Cities and Society 78 (March 2022): 103647. https://doi.org/10.1016/j.scs.2021.103647.

[17] Luhby, "Chicago: America's Most Segregated City.", TV Broadcast. CNNMoney (New York), January 5, 2016. https://money.cnn.com/2016/01/05/news/economy/chicago-segregated/

[18] Chicago Climate Action Plan." Gov, 2008,
https://www.chicago.gov/content/city/en/progs/env/climateaction.html.

[19] Chen, Jianli, Godfried Augenbroe, and Xinyi Song, "Impact of Outdoor Air Quality on the Natural Ventilation Usage of Commercial Buildings in the US." Applied Energy 235 (February 2019): 673–84. https://doi.org/10.1016/j.apenergy.2018.11.020.

[20] EERE, “Low-Income Energy Affordability Data - LEAD Tool - 2018 Update.” DOE Open Energy Data Initiative (OEDI); U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, 2020. https://doi.org/10.25984/1784729.
[21] Wilson et al., “Evaluating Energy Efficiency Potential", 2019.
[22] Brosemer, Kathleen, Chelsea Schelly, Valoree Gagnon, Kristin L. Arola, Joshua M. Pearce, Douglas Bessette, and Laura Schmitt Olabisi, “The Energy Crises Revealed by COVID.”The Energy Crises Revealed by COVID: Intersections of Indigeneity, Inequity, and Health.” Energy Research & Social Science 68 (October 2020): 101661. https://doi.org/10.1016/j.erss.2020.101661.
[23] McMonagle, Castellanos, and Sutaria Patel, “Advancing Energy Justice as a Climate and Public Health Solution.” World Medical & Health Policy 13, no. 1 (March 2021): 146–53. https://doi.org/10.1002/wmh3.420
[24] Spataru, Catalina, Paul Drummond, Eleni Zafeiratou, and Mark Barrett., “Long-Term Scenarios for Reaching Climate Targets and Energy Security in UK.” Sustainable Cities and Society 17 (September 2015): 95–109. https://doi.org/10.1016/j.scs.2015.03.010.
[25] Drehobl and Ross, “How Energy Efficiency Can Improve Low Income and Underserved Communities.” 2015, 56
[26] Chen, Augenbroe, “Evaluating the Potential of Hybrid Ventilation", 1648-61.
[27] Song et al., “Natural Ventilation in London.” Building and Environment 195 (May 2021): 107722. https://doi.org/10.1016/j.buildenv.2021.107722.
[28] Drehobl, Ross, and Ayala, “An Assessment of National and Metropolitan Energy Burden across the United States.” 2020, 80.

## BIBLIOGRAPHY

Agbim, Chinelo, Felipe Araya, Kasey M. Faust, and Dana Harmon. “Subjective versus Objective Energy Burden: A Look at Drivers of Different Metrics and Regional Variation of Energy Poor Populations.” Energy Policy 144 (September 1, 2020): 111616. https://doi.org/10.1016/j.enpol.2020.111616.

Ashayeri, Mehdi, and Narjes Abbasabadi. “A Framework for Integrated Energy and Exposure to Ambient Pollution (IEnEx) Assessment toward Low-Carbon, Healthy, and Equitable Cities.” Sustainable Cities and Society 78 (March 2022): 103647. https://doi.org/10.1016/j.scs.2021.103647.

Bednar, Dominic J., and Tony G. Reames. “Recognition of and Response to Energy Poverty in the United States.” Nature Energy 5, no. 6 (June 2020): 432–39. https://doi.org/10.1038/s41560-020-0582-0.

Ben-David, Tom, and Michael S. Waring. “Impact of Natural versus Mechanical Ventilation on Simulated Indoor Air Quality and Energy Consumption in Offices in Fourteen U.S. Cities.” Building and Environment 104 (August 2016): 320–36. https://doi.org/10.1016/j.buildenv.2016.05.007.

Bienvenido-Huertas, David, Daniel Sánchez-García, and Carlos Rubio-Bellido. “Analysing Natural Ventilation to Reduce the Cooling Energy Consumption and the Fuel Poverty of Social Dwellings in Coastal Zones.” Applied Energy 279 (December 2020): 115845. https://doi.org/10.1016/j.apenergy.2020.115845.

Bouzarovski, Stefan, and Neil Simcock. “Spatializing Energy Justice.” Energy Policy 107 (August 1, 2017): 640–48. https://doi.org/10.1016/j.enpol.2017.03.064.

Brosemer, Kathleen, Chelsea Schelly, Valoree Gagnon, Kristin L. Arola, Joshua M. Pearce, Douglas Bessette, and Laura Schmitt Olabisi. “The Energy Crises Revealed by COVID: Intersections of Indigeneity, Inequity, and Health.” Energy Research & Social Science 68 (October 2020): 101661. https://doi.org/10.1016/j.erss.2020.101661.

Bullard, Robert D., Paul Mohai, Robin Saha, and Beverly Wright. “Toxic wastes and race at twenty: why race still matters after all of these years.” Environmental Law 38, no. 2 (2008): 371–411.

Burnett, Richard, Hong Chen, Mieczysław Szyszkowicz, Neal Fann, Bryan Hubbell, C. Arden Pope, Joshua S. Apte, et al. “Global Estimates of Mortality Associated with Long-Term Exposure to Outdoor Fine Particulate Matter.” Proceedings of the National Academy of Sciences 115, no. 38 (September 18, 2018): 9592–97. https://doi.org/10.1073/pnas.1803222115.

Scientific Brief: SARS-CoV-2 Transmission. “Center for Disease Control and Prevention.” Governmental, October 5, 2020. https://www.cdc.gov/coronavirus/2019-ncov/more/scientific-brief-sars-cov-2.html.

Chen, Jianli, Godfried Augenbroe, and Xinyi Song. “Evaluating the Potential of Hybrid Ventilation for Small to Medium Sized Office Buildings with Different Intelligent Controls and Uncertainties in US Climates.” Energy and Buildings 158 (January 2018): 1648–61. https://doi.org/10.1016/j.enbuild.2017.12.004.

———. “Evaluating the Potential of Hybrid Ventilation for Small to Medium Sized Office Buildings with Different Intelligent Controls and Uncertainties in US Climates.” Energy and Buildings 158 (January 2018): 1648–61. https://doi.org/10.1016/j.enbuild.2017.12.004.

Chen, Jianli, Gail S. Brager, Godfried Augenbroe, and Xinyi Song. “Impact of Outdoor Air Quality on the Natural Ventilation Usage of Commercial Buildings in the US.” Applied Energy 235 (February 2019): 673–84. https://doi.org/10.1016/j.apenergy.2018.11.020.

“Chicago Climate Action Plan.” Gov, 2008. https://www.chicago.gov/content/city/en/progs/env/climateaction.html.

Drehobl, Ariel, and Lauren Ross. “How Energy Efficiency Can Improve Low Income and Underserved Communities,” 2015, 56.

Drehobl, Ariel, Lauren Ross, and Roxana Ayala. “An Assessment of National and Metropolitan Energy Burden across the United States,” 2020, 80.

Edenhofer, Ottmar, Ramon Pichs-Madruga, Youba Sokona, Jan C. Minx, Ellie Farahani, Susanne Kadner, Kristin Seyboth, et al., eds. *Climate Change 2014: Mitigation of Climate Change ; Summary for Policymakers Technical Summary ; Part of the Working Group III Contribution to the Fifth Asessment Report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland: Intergovernmental Panel on Climate Change, 2015.

EERE, LEAD. “Low-Income Energy Affordability Data - LEAD Tool - 2018 Update.” DOE Open Energy Data Initiative (OEDI); U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, 2020. https://doi.org/10.25984/1784729.

Greenston, Michael, and Claire Qing Fan. “Introducing the Air Quality Life Index: Twelve Facts about Particulate Air Pollution, Human Health, and Global Policy.” Energy Policy Institute at the University of Chicago, November 2018. https://aqli.epic.uchicago.edu/wp-content/uploads/2018/11/AQLI-Report.111918-2.pdf.

Johnson P E. “Two Steps Forward on Environmental Justice.” Environmental Health Perspectives 102, no. 10 (October 1, 1994): 836–38. https://doi.org/10.1289/ehp.94102836.

Luhby, Tami. “Chicago: America’s Most Segregated City.” TV Broadcast. CNNMoney (New York), January 5, 2016. https://money.cnn.com/2016/01/05/news/economy/chicago-segregated/.

McMonagle, Rachel, Ivana Castellanos, and Surili Sutaria Patel. “Advancing Energy Justice as a Climate and Public Health Solution.” World Medical & Health Policy 13, no. 1 (March 2021): 146–53. https://doi.org/10.1002/wmh3.420.

Reames, Tony Gerard. “Targeting Energy Justice: Exploring Spatial, Racial/Ethnic and Socioeconomic Disparities in Urban Residential Heating Energy Efficiency.” Energy Policy 97 (October 1, 2016): 549–58. https://doi.org/10.1016/j.enpol.2016.07.048.

Schlosberg, David. *Defining Environmental Justice: Theories, Movements, and Nature*. Oxford University Press, 2009

Google-Books-ID: SBkUDAAAQBAJ

Setti, Leonardo, and et.al. “Evaluation of the Potential Relationship between Particulate Matter (PM) Pollution and COVID-19 Infection Spread in Italy.” University of Bologna, Italy; University of Bari, Italy; University of Milano, Italy; University of Trieste, Italy; - Italian Society of Environmental Medicine, 2020.

Setti, Leonardo, Fabrizio Passarini, Gianluigi De Gennaro, Pierluigi Barbieri, Maria Grazia Perrone, Andrea Piazzalunga, Massimo Borelli, et al. “The Potential Role of Particulate Matter in the Spreading of COVID-19 in Northern Italy: First Evidence-Based Research Hypotheses.” Preprint. Public and Global Health, April 17, 2020. https://doi.org/10.1101/2020.04.11.20061713.

Song, Jiyun, Xinjie Huang, Dachuan Shi, William E. Lin, Shiwei Fan, and Paul F. Linden. “Natural Ventilation in London: Towards Energy-Efficient and Healthy Buildings.” Building and Environment 195 (May 2021): 107722. https://doi.org/10.1016/j.buildenv.2021.107722.

Spataru, Catalina, Paul Drummond, Eleni Zafeiratou, and Mark Barrett. “Long-Term Scenarios for Reaching Climate Targets and Energy Security in UK.” Sustainable Cities and Society 17 (September 2015): 95–109. https://doi.org/10.1016/j.scs.2015.03.010.

Tong, Zheming, Yujiao Chen, Ali Malkawi, Zhu Liu, and Richard B. Freeman. “Energy Saving Potential of Natural Ventilation in China: The Impact of Ambient Air Pollution.” Applied Energy 179 (October 2016): 660–68. https://doi.org/10.1016/j.apenergy.2016.07.019.

Wilson, Adrian, Jacqueline Patterson, Kimberly Wasserman, Amanda Starbuck, Annie Sartor, Judy Hatcher, John Fleming, and Katie Fink. “Coal Blooded: Putting Profits Before People.” National Association for the Advancement of Colored People (NAACP), Indigenous Environmental Network, LIttle Village Environmental Justice Organization, November 2012. http://www.naacp.org/pages/coal-blooded1.

Wilson, Eric J.H., Chioke B. Harris, Joseph J. Robertson, and John Agan. “Evaluating Energy Efficiency Potential in Low-Income Households: A Flexible and Granular Approach.” Energy Policy 129 (June 2019): 710–37. https://doi.org/10.1016/j.enpol.2019.01.054.

# HOW HAS THE PANDEMIC AFFECTED OLDER ADULTS? A QUALITATIVE STUDY INVOLVING SERVICE PROVIDERS AND COMMUNITY-DWELLING OLDER ADULTS IN SCOTLAND

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## INTRODUCTION

This paper discusses the effects of the pandemic on older adults and elderly services in the context of investigating loneliness and social isolation in later life. The findings were extracted from ongoing practice-led research that explores the possibility of relieving loneliness in later life through a remote co-design approach with community-dwelling older adults in Scotland.

Older adults, as the most vulnerable group to the COVID-19 virus, have been dramatically impacted by the pandemic in terms of both physical and mental health. It is well understood that the SARS-CoV-2 causes worse consequences and a higher mortality rate in patients older than 60 and those with comorbidities.[1,2] To stop the spread of the virus, intense measures were adopted by authorities in multiple countries to impose a quarantine status.[3] For example, China, as the first country that detected the new virus, shut down Wuhan, the city of eleven million people, on January 23, 2020.[4] Following the formal declaration of the novel coronavirus outbreak as a Public Health Emergency of International Concern,[5,6] the US declared a public health emergency on February 3, 2020,[7] and the Prime Minister in the UK announced the first lockdown and ordered people to 'stay at home' on March 23, 2020.[8] With the start of this unprecedented prolonged mass quarantine, a range of collateral effects have been identified.

For instance, research shows that the suspension of public transport services due to quarantine restrictions and the narrow focus of the healthcare system in the management of COVID-19 cases has caused difficulty for older adults in obtaining maintenance treatments, resulting in the deferral of their regular maintenance medication.[9,10] Although the Internet use has exponentially increased among the older population,[11] (taking the statistic in the UK as an example, of which the proportion of internet users aged 75 and over nearly doubled from 29% in 2013 to 54% in 2020,[12]) and online health services have been widely promoted and adopted during the quarantine, the statistic show that nearly half of people aged 75 and over do not use the Internet in the UK. This implies that only a small group of older adults may benefit from online service provisions.[13]

In terms of the pandemic's effects on the physical health of older adults, a narrative review of 20,069 older adults indicates that social distancing due to the pandemic could lead to a decrease in physical activity level and an increase in sedentary behaviour,[14] which are associated with an increased risk of

all-cause mortality in the elderly.[15,16] Negative psychological effects created by this period of quarantine also cause the physical inactivity of older adults. For example, research conducted in Japan indicates that the COVID-19 pandemic increases the Fear of Falling (FOF) of older adults.[17] It found that no significant changes in physical pain and locomotive disabilities in older adults approximately two months after the announcement of the first state of emergency in Japan. However, the increase in the anxiety of older adults regarding FOF was significant and led to physical inactivity, further symptoms of depression and a poor quality of life.[18]

Regarding other psychological effects among older adults, research[19] shows that this prolonged period of COVID-19 restrictions can amplify social isolation, loneliness, and prior social losses, and create boredom, dullness, and overwhelming feelings of being trapped. This is especially true for older adults who are excluded from technology-based alternatives for socializing. These emotional effects can linger beyond the recommencement of city activities. Some older adults reported a feeling of being left out as a result of their attempt to avoid contracting COVID-19.[20,21]

Other effects of the pandemic, including economic setbacks, the loss of retirement savings and the increase in ageism, racism and classism were identified in multiple research studies.[22,23,24] Although a series of the pandemic's effects on older adults has been investigated through a quantitative perspective as demonstrated above, scholars point out that its impacts on the further physical and emotional well-being of older adults are yet to be determined. [25] To fill the gap and expand the understanding of how the pandemic has affected older adults, this paper aims to add insights through a qualitative lens and further discuss some positive effects that are rarely mentioned in other papers.

## RESEARCH DESIGN AND METHODS

As aforementioned, this investigation is based on ongoing practice-led research exploring the possibility of relieving loneliness in later life through a remote co-design approach with community-dwelling older people in Scotland. Employed snowball sampling,[26] this research involves twenty service providers from twelve organisations and fourteen older adults living independently in Edinburgh, Glasgow, and Stirling.

### Data Collection

Thirty semi-structured interviews and two focus groups were conducted between May, 2020 to February, 2021. In line with COVID restrictions, all conversations were carried out remotely with tools including telephone, Zoom, FaceTime, WeChat, and Messenger. A written list of questions and topics structured in a particular older was prepared as the interview guide.[27] Open-ended questions (e.g., what is the first idea jump into your mind when referring to loneliness?) followed by more specific questions (e.g., does COVID-19 pandemic change your perspective?) were asked flexibly depending on the background of the informants and the flow of the conversations.

### Data Analysis

All interviews and focus groups were audio-recorded and verbatim transcribed. The data were analysed on qualitative data analysis software – Nvivo 12 with the Charmaz[28] and Bernard[29] approaches to grounded theory. At the initial stage of open coding, I first identified the themes that emerged from the text, assigned conceptual labels to them, and pulled out relevant quotations and categorised them under different themes. For the axial coding, these conceptual labels were compared and re-organised. With these refined categories and themes, their relationships and links were easier to discern. Finally, a written finding summary was sent to three service providers and nine older informants for validation. I also organised an online chat room on Zoom specifically for older

informants for providing them with flexible approaches to convey feedback. This process can enhance the credibility of the research data,[30] and all responses confirmed the validity of the findings.

## FINDINGS AND DISCUSSION

Four categories emerged from the process of axial coding: (a) perceived losses in physical functions; (b) losses in a psychological dimension; (c) barriers to information technology adoption; and (d) positive changes.

### Perceived losses in physical functions

The pandemic's effects on the physical health of older adults are notable. The perceived losses in physical functions were raised multiple times in interviews and focus groups with older informants. They indicated three types of physical functions that they observed the deterioration in either their own bodies or others' close to them. These physical functions include muscle strength, speaking ability and memory.

'Unfortunately, because of lockdown, she is never going to be able to do that again. She will not be able to go out on her own again, get on buses by herself. She has lost confidence and she has lost strength in the legs.'[31] This remark was made by an older informant when she was describing the changes she observed in the locomotive ability of her mother, who was ninety-four years old, after she experienced the first lockdown in the UK. The other older informant in the focus group explained further 'as you get older, your muscle strength gets much less and you lose muscle.'[31]

In terms of speaking ability, in another focus group involving a service provider, an older informant and her daughter,[32] the older informant is living with her daughter, and her daughter observed that 'my mom, when she is speaking, she is losing her voice because she is not speaking a lot. And that has happened since the pandemic. Her voice goes sort of strange and funny because she is not using her voice as much.'[32] The older informant added 'my voice began to go, because I have lost all this interaction that I had with certain groups of people. So, now, I started to talk to the cat and I do not even have a conversation.'[32]

Memory is the third type of loss identified through conversations. 'She had a wonderful memory and now she [says], "I cannot remember what was that place we were" and it is not like her. So physically and mentally, she is much worse since the pandemic started.'[33] This remark was given by an older informant in an interview when she was described her friend's situation, who is in her 90s.

These remarks deliver two pieces of key information. First, these perceived losses in physical functions are all related to abrupt physical inactivity. The unprecedented measures imposed internationally by authorities for mitigating the spread of COVID-19 reduced both the incidental and planned physical activity (PA) of older adults, and a strong association between physical inactivity and the deterioration in overall health has been proven in multiple research.[34,35,36] Second, these remarks demonstrate 'perceived losses' rather than 'actual losses' in these physical functions. In the interviews and focus groups, none of the informants mentioned that they took standard medical examinations in the changes of these actual physical functions. Although the strong association between physical inactivity and the deterioration in overall health has been proven, different opinions are existing regarding whether this deconditioning process could happen in months during the pandemic period or not.[37,38,39] Therefore, rather than actually losing part of these physical functions at a medical level, I believe the older informants of this research were more possibly experiencing a perceived loss in the familiarity with some of the physical functions pointed out above.

### Loss in a psychological dimension

Again, the word 'loss' here plays a key role in the pandemic's effects on the psychological dimension of older adults. Five themes emerged from the stage of open coding: (a) the loss of confidence; (b) the loss of routines; (c) the loss of control over one's life (d) the loss of social interactions; and (e) the loss of hope.

Notably, these themes are not totally independent; a thread of development was discovered that strings them together. Due to the fact that the COVID-19 virus can spread between people and has deadly impacts on older adults, [40,41] the investigation shows that this loss in a psychological dimension of older adults would start with losing confidence in the safety of public places, including bars, buses, and hospitals. 'I think the thing that actually worries me is I have not actually been to the doctors or the hospital or anything like that because I am afraid to do any of these things, because there might be lots of people there got infections.'[42]

This worry and loss in confidence in going out would lead to changes in their usual routines. Older adults' feelings brought about by this change include boredom, isolation, loneliness and depression. For instance, one informant stated, 'I am twiddling my thumbs. As you see I have got nothing much to do at the moment, so it gets a bit kind of, you know, you get a bit fed up and bored.'[43] The emptiness in their days has consumed their energy and created a sense of losing control over their life. They have had to figure out what they should do to fill the time, so tiredness is another feeling indicated in the conversations.

Entering the next stage, older adults started to feel a loss in interactions with other people. An older informant expressed 'I am going to clean this cupboard, going to do washing or whatever. But after a while, your mind begins to concentrate on your loneliness. Your mind thinks, I have not heard a human voice in this room for so many hours.'[44] The danger of this loss is that in the long run, it deprives older adults' chances to both express themselves and receive valid feedback; as one informant stated, 'I am not getting any real feedback and you are not getting my energy.'[45] These chances to express themselves and receive feedback are crucial for older adults to confirm and maintain their self-worth and self-identity.

The final stage on this thread is the loss of hope. 'It can be a very, very long day for people that are lonely. Each day is the same, nothing is happening. Up here, you start to think, are we ever going to get out of this?'[46] This loss in hope would leave lasting emotional effects on older adults and further demotivate them to engage with others and in the outside world and trap them in a loop of loneliness, [47] leading them to develop depression.

### Barriers to information technology adoption

This prolonged period of mass quarantines and social distancing has acutely reduced the possibility of in-person communication, but has greatly propelled the popularity of information technology (IT). However, both service providers and older adults are facing various barriers to IT adoption during this transition. Three difficulties are identified in the research.

#### The difficulty in accessing basic resources

It seems logical that having the relevant resources, including the Internet and devices is a precondition of accessing digital service provisions. However, this is a principal barrier for some older adults according to service providers. For example, when asked how she has adapted her work of visiting older people during the pandemic, a community link worker[48] indicated, 'I do not really video call anyone, mostly because older people do not have access to the technology.'[49] Other service providers have claimed that to address this situation, they or their organisations applied for funding and provided free digital tablets to some older adults; however, the effects have not been as positive as

expected due to the difficulty of providing training, and the limitation regarding the number of available devices.[50,51,52]

### The difficulty in providing training and facilitation programmes

The older population who are equipped with the basic resources are still experiencing a steep learning curve.[53] Therefore, basic training programmes and constant facilitation are vital to alleviate older adults' initial fear and help them become familiar with operations. However, this study reveals that IT training and facilitation programmes have faced major challenges during the pandemic. For example, an IT service provider points out, 'if a learner is very basic in knowledge, it is a real challenge … If you are trying to explain to someone "Click here, press this key" … I think the main thing is [that] it is much slower to try and teach someone remotely, particularly if they are just starting off with technology.'[54] This difficulty in providing assistance can discourage learners from adopting IT, as well as frustrate older adults who seek support.

### The difficulty in operating information technology

The difficulty discussed in the previous section is a dual challenge. Service providers face difficulty in delivering training and facilitation to older adults, and older adults, in turn, face difficulty in receiving support with using IT. Therefore, fears, for example, pressing the wrong buttons (which was the most mentioned concern) – can hinder older adults in adopting and benefiting from IT service provisions. For instance, an older informant described her experience of introducing an online service to her friend: 'She was kind of scared and worried. … She loses things on it, presses the wrong buttons. I think that is one of the fears as well when you are trying to do that. You are not too savvy about it. … She does not know how to do it. [55] She just does not know. And she could be using that; that could be helping her, but there is nobody there to help her do it.'[56] The frustration of experiencing difficulty in operating IT and accessing online services that other people seem to do easily can even damage individuals' self-confidence and self-value.

## Positive changes

Along with the negative effects of the pandemic identified in the previous sections, positive effects were also captured in the interviews and focus groups. Two themes emerged from the stage of open coding: (a) reassessing the importance of human interaction and connection and (b) realising the benefits of being able to use IT.

### Reassessing the importance of human interaction and connection

In line with the literature that states the pain of social disconnection is a 'driving force' that motivates one to seek and maintain social connections, [57,58] older adults have started to reassess the importance of human interaction and make changes due to the prolonged period of social disconnect during this pandemic. For example, one older informant expressed that 'people have been talking much more casually to each other, greeting, saying hello, even though two meters' distance. And during the pandemic, I have stopped and talked to more people … People are being more concerned about other people.'[59] This change in attitude can create not only an immediate change in individuals' behaviours, but also a lasting effect on future community services. As suggested by an organiser of community activity, 'maybe after the pandemic, people will be more willing to mix with each other.'[60]

### Realising the benefits of being able to use IT

In addition to the barriers to IT adoption discussed in the previous section, changes in attitude towards IT were also identified in the interviews and focus groups. 'I see it as a blessing.'[61] said one older informant. Although this prolonged period of social isolation has 'forced' a large number of older adults to learn to use IT, it also has provided an opportunity and created a 'must use' environment for older adults to adopt the digital trend and receive the benefits of using IT. Another older informant said, 'I have been very fortunate I never thought I would say "thank goodness for technology".'[62] This shift in attitude towards IT may benefit future work in promoting information technology among older populations and the development of online elderly services.

## CONCLUSION

The overall aim of this paper is to expand on the knowledge of how the pandemic has affected older adults through a qualitative lens. The findings highlight the 'losses' in physical and psychological effects on older adults from multiple dimensions, as well as the barriers relating to IT delivery and adoption, but they also reveal the positive changes in the attitude of older adults regarding human connections and using IT. The findings are consistent with the quantitative results of previous research and provide a detailed deeper understanding of how the pandemic and resulting mass quarantines have influenced older adults. I suggest that future research considers the potential positive effects of the pandemic on older adults in more detail and explores how these can be leveraged to benefit the development and promotion of elderly interventions and services.

## NOTES

[1] Zainab Shahid et al., “COVID-19 and Older Adults: What We Know,” Journal of the American Geriatrics Society 68, no. 5 (2020): 926, https://doi.org/10.1111/jgs.16472.
[2] David Jiménez-Pavón, Ana Carbonell-Baeza, and Carl J. Lavie, “Physical Exercise as Therapy to Fight against the Mental and Physicalconsequences of COVID-19 Quarantine Special Focus in Older People,” Prog Cardiovasc Dis 63, no. 3 (2020): 386, https://doi.org/10.1016/j.pcad.2020.03.009.
[3] Jiménez-Pavón, Carbonell-Baeza, and Lavie, 386.
[4]China Daily, “Virus-Hit City Temporarily Shuts down Local Transportation,” Health, 2020, accessed December 22, 2021, https://www.chinadaily.com.cn/a/202001/23/WS5e28978ea310128217272dae.html.
[5]World Health Organization, “Archived: WHO Timeline - COVID-19,” News, 2020, accessed July 09, 2021, https://www.who.int/news/item/27-04-2020-who-timeline---covid-19.
[6]World Health Organization, “COVID-19 - China,” Disease Outbreak News, 2020, accessed April 03, 2020, https://www.who.int/emergencies/disease-outbreak-news/item/2020-DON229.
[7] AJMC Staff, “A Timeline of COVID-19 Developments in 2020,” AJMC, 2021, accessed January 19, 2022, https://www.ajmc.com/view/a-timeline-of-covid19-developments-in-2020.
[8] Institute for Government analysis, “Timeline of UK Lockdowns, March 2020 to March 2021,” Charts, 2022, accessed January 13, 2022, https://www.instituteforgovernment.org.uk/charts/uk-government-coronavirus-lockdowns.
[9] Yuan Yang et al., “Mental Health Services for Older Adults in China during the COVID-19 Outbreak,” The Lancet Psychiatry 7, no. 4 (2020): e19, https://doi.org/10.1016/S2215-0366(20)30079-1.
[10] Nancy Morrow-Howell, Natalie Galucia, and Emma Swinford, “Recovering from the COVID-19 Pandemic: A Focus on Older Adults,” Journal of Aging and Social Policy 32, no. 4–5 (2020): 528, https://doi.org/10.1080/08959420.2020.1759758.
[11] Bo Xie et al., “When Going Digital Becomes a Necessity: Ensuring Older Adults’ Needs for Information, Services, and Social Inclusion During COVID-19,” Journal of Aging and Social Policy 32, no. 4–5 (2020): 461, https://doi.org/10.1080/08959420.2020.1771237.
[12] Office of National Statistics, “Internet Users, UK: 2020,” IT and internet industry, 2021, accessed January 13, 2022, https://www.ons.gov.uk/businessindustryandtrade/itandinternetindustry/bulletins/internetusers/2020.
[13] Xie et al., “When Going Digital Becomes a Necessity,” 461.
[14] W. SEPÚLVEDA-LOYOLA et al., “Impact of Social Isolation Due to COVID-19 on Health in Older People: Mental and Physical Effects and Recommendations Recomendaciones.,” J Nutr Health Aging 24, no. 9 (2020): 938–947, http://10.0.3.239/s12603-020-1469-2.
[15] Conor Cunningham and Roger O’ Sullivan, “Why Physical Activity Matters for Older Adults in A Time of Pandemic,” European Review of Aging and Physical Activity 17, no. 16 (2020): 2, https://doi.org/10.1186/s11556-020-00249-3.
[16] Leandro Fornias Machado De Rezende et al., “Sedentary Behavior and Health Outcomes among Older Adults: A Systematic Review,” BMC Public Health 14, no. 333 (2014): 1.
[17] Misa Nakamura et al., “Increased Anxiety about Falls and Walking Ability among Community-dwelling Japanese Older Adults during the COVID-19 Pandemic,” Psychogeriatrics, no. January (2021): 1-6, https://doi.org/10.1111/psyg.12750.
[18] Nakamura et al., 5.
[19] Ashwin A. Kotwal et al., “Social Isolation and Loneliness Among San Francisco Bay Area Older Adults During the COVID-19 Shelter-in-Place Orders,” Journal of the American Geriatrics Society 69, no. 1 (2021): 27, https://doi.org/10.1111/jgs.16865.
[20] Morrow-Howell, Galucia, and Swinford, “Recovering from the COVID-19 Pandemic,” 528.
[21] Kotwal et al., “Social Isolation and Loneliness Among San Francisco Bay Area Older Adults During the COVID-19 Shelter-in-Place Orders,” 26.
[22] Morrow-Howell, Galucia, and Swinford, “Recovering from the COVID-19 Pandemic,” 526–35.
[23] Joanne Brooke and Debra Jackson, “Older People and COVID-19: Isolation, Risk and Ageism,” Journal of Clinical Nursing 29, no. 13–14 (2020): 2044, https://doi.org/10.1111/jocn.15274.
[24] Sarah Fraser et al., “Ageism and COVID-19: What Does Our Society’s Response Say about Us?,” *Age and Ageing* 49, no. 5 (2020): 692–95, https://doi.org/10.1093/ageing/afaa097.
[25] Morrow-Howell, Galucia, and Swinford, “Recovering from the COVID-19 Pandemic,” 529.
[26] H. Russell Bernard, *Social Research Methods : Qualitative and Quantitative Approaches*, book (Thousand Oaks ; London: Sage Publications, 2000), 179.

[27] Bernard, 191.
[28] Kathy Charmaz, *Constructing Grounded Theory: A Pratical Guide Through Qualitative Analysis* (London, Thousand Oaks, New Delhi: SAGE Publications, 2006), https://doi.org/10.1186/s12868-016-0320-5.
[29] Bernard, *Social Research Methods : Qualitative and Quantitative Approaches*, 443–456.
[30] Tricia s. Moore, Stephen D. Lapan, and MaryLynn T. Quartaroli, "Case Study Research," in *Qualitative Research: An Introduction to Methods and Designs* (San Francisco: Jossey-Bass, 2012), 251.
[31] Focus group with older informants, October 27, 2020.
[32] Focus group with a service provider, an older informant and a daughter of the older informant, December 01, 2020.
[33] Interview with an older informant, November 05, 2020.
[34] Hamilton Roschel, Guilherme G. Artioli, and Bruno Gualano, "Risk of Increased Physical Inactivity During COVID-19 Outbreak in Older People: A Call for Actions," *Journal of the American Geriatrics Society* 68, no. 6 (2020): 1126–1128, https://doi.org/10.1111/jgs.16550.
[35] Sepúlveda-Loyola et al., "Impact of Social Isolation Due to COVID-19 on Health in Older People: Mental and Physical Effects and Recommendations Recomendaciones.," 944.
[36] Roschel, Artioli, and Gualano, "Risk of Increased Physical Inactivity During COVID-19 Outbreak in Older People: A Call for Actions," 1126.
[37] Cunningham and O' Sullivan, "Why Physical Activity Matters for Older Adults in A Time of Pandemic," 2.
[38] Nakamura et al., "Increased Anxiety about Falls and Walking Ability among Community-dwelling Japanese Older Adults during the COVID-19 Pandemic," 5.
[39] Roschel, Artioli, and Gualano, "Risk of Increased Physical Inactivity During COVID-19 Outbreak in Older People: A Call for Actions," 1126.
[40] World Health Organization, "Coronavirus Disease (COVID-19): How Is It Transmitted?," Questions and Answers, 2021, accessed January 20, 2022 https://www.who.int/news-room/questions-and-answers/item/coronavirus-disease-covid-19-how-is-it-transmitted.
[41] Shahid et al., "COVID-19 and Older Adults: What We Know," 926.
[42] Interview with an older informant, January 21, 2021.
[43] Focus group with a service provider, an older informant and a daughter of the older informant, December 01, 2020.
[44] Interview with an older informant, November 05, 2020.
[45] Focus group with older informants, October 27, 2020.
[46] Interview with an older informant, January 21, 2021.
[47] John T. Cacioppo and Louise C. Hawkley, "Perceived Social Isolation and Cognition," *Trends Cogn Sci* 13, no. 10 (2009): 452, https://doi.org/10.1016/j.tics.2009.06.005.
[48] ScotPHN, "What Is a Community Link Worker?" (Edinburgh, 2018), 1–7.
[49] Interview with a service provider, December 02, 2020.
[50] Interview with a service provider, July 21, 2020.
[51] Interview with a service provider, December 02, 2020.
[52] Interview with a service provider, December 09, 2020.
[53] Focus group with older informants, October 27, 2020.
[54] Interview with a service provider, December 09, 2020.
[55] Accessing an online service mentioned in the previous conversation.
[56] Focus group with a service provider, an older informant and a daughter of the older informant, December 01, 2020.
[57] Robert S. Weiss, "The Study of Loneliness," in *Loneliness: The Experience of Emotional and Social Isolation*, First MIT (Cambridge, Massachusetts; London, England: The MIT Press, 1975), 9.
[58] Louise C. Hawkley and John T. Cacioppo, "Loneliness Matters: A Theoretical and Empirical Review of Consequences and Mechanisms," *Annals of Behavioral Medicine* 40, no. 2 (2010): 218, https://doi.org/10.1007/s12160-010-9210-8.
[59] Meeting with older informants for validating the findings.
[60] Focus group with a service provider, an older informant and a daughter of the older informant, December 01, 2020.
[61] Interview with an older informant, January 21, 2021.
[62] Focus group with older informants, October 27, 2020.

## BIBLIOGRAPHY

AJMC Staff. “A Timeline of COVID-19 Developments in 2020.” AJMC, 2021, accessed January 19, 2022, https://www.ajmc.com/view/a-timeline-of-covid19-developments-in-2020.

Bernard, H. Russell. *Social Research Methods : Qualitative and Quantitative Approaches*. Book. Thousand Oaks ; London: Sage Publications, 2000.

Brooke, Joanne, and Debra Jackson. “Older People and COVID-19: Isolation, Risk and Ageism.” Journal of Clinical Nursing 29, no. 13–14 (2020): 2044–2046. https://doi.org/10.1111/jocn.15274.

Cacioppo, John T., and Louise C. Hawkley. “Perceived Social Isolation and Cognition.” Trends Cogn Sci 13, no. 10 (2009): 447–454. https://doi.org/10.1016/j.tics.2009.06.005.

Charmaz, Kathy. *Constructing Grounded Theory: A Pratical Guide Through Qualitative Analysis*. London, Thousand Oaks, New Delhi: SAGE Publications, 2006. https://doi.org/10.1186/s12868-016-0320-5.

China Daily. “Virus-Hit City Temporarily Shuts down Local Transportation.” Health, 2020. accessed December 22, 2021, https://www.chinadaily.com.cn/a/202001/23/WS5e28978ea310128217272dae.html.

Cunningham, Conor, and Roger O’ Sullivan. “Why Physical Activity Matters for Older Adults in A Time of Pandemic.” European Review of Aging and Physical Activity 17, no. 16 (2020): 1–4. https://doi.org/10.1186/s11556-020-00249-3.

Fraser, Sarah, Martine Lagacé, Bienvenu Bongué, Ndatté Ndeye, Jessica Guyot, Lauren Bechard, Linda Garcia, et al. “Ageism and COVID-19: What Does Our Society’s Response Say about Us?” *Age and Ageing* 49, no. 5 (2020): 692–695. https://doi.org/10.1093/ageing/afaa097.

Hawkley, Louise C., and John T. Cacioppo. “Loneliness Matters: A Theoretical and Empirical Review of Consequences and Mechanisms.” Annals of Behavioral Medicine 40, no. 2 (2010): 218–227. https://doi.org/10.1007/s12160-010-9210-8.

Institute for Government analysis. “Timeline of UK Lockdowns, March 2020 to March 2021.” Charts, 2022, accessed January 13, 2022, https://www.instituteforgovernment.org.uk/charts/uk-government-coronavirus-lockdowns.

Jiménez-Pavón, David, Ana Carbonell-Baeza, and Carl J. Lavie. “Physical Exercise as Therapy to Fight against the Mental and Physicalconsequences of COVID-19 Quarantine Special Focus in Older People.” Prog Cardiovasc Dis 63, no. 3 (2020): 386–388. https://doi.org/10.1016/j.pcad.2020.03.009.

Kotwal, Ashwin A., Julianne Holt-Lunstad, Rebecca L. Newmark, Irena Cenzer, Alexander K. Smith, Kenneth E. Covinsky, Danielle P. Escueta, Jina M. Lee, and Carla M. Perissinotto. “Social Isolation and Loneliness Among San Francisco Bay Area Older Adults During the COVID-19 Shelter-in-Place Orders.” Journal of the American Geriatrics Society 69, no. 1 (2021): 20–29. https://doi.org/10.1111/jgs.16865.

Moore, Tricia s., Stephen D. Lapan, and MaryLynn T. Quartaroli. “Case Study Research.” In *Qualitative Research: An Introduction to Methods and Designs*, 243–270. San Francisco: Jossey-Bass, 2012.

Morrow-Howell, Nancy, Natalie Galucia, and Emma Swinford. “Recovering from the COVID-19 Pandemic: A Focus on Older Adults.” Journal of Aging and Social Policy 32, no. 4–5 (2020): 526–535. https://doi.org/10.1080/08959420.2020.1759758.

Nakamura, Misa, Masakazu Imaoka, Hidetoshi Nakao, Mitsumasa Hida, Ryota Imai, Fumie Tazaki, and Masatoshi Takeda. “Increased Anxiety about Falls and Walking Ability among Community-dwelling Japanese Older Adults during the COVID-19 Pandemic.” Psychogeriatrics, no. January (2021): 1–6. https://doi.org/10.1111/psyg.12750.

Office of National Statistics. “Internet Users, UK: 2020.” IT and internet industry, 2021, accessed January 13, 2022https://www.ons.gov.uk/businessindustryandtrade/itandinternetindustry/bulletins/internetusers/2020.

Rezende, Leandro Fornias Machado De, Juan Pablo Rey-Lo ́pez, Victor Keihan Rodrigues Matsudo, and Olinda Do Carmo Luiz. “Sedentary Behavior and Health Outcomes among Older Adults: A Systematic Review.” BMC Public Health 14, no. 333 (2014): 1–9.

Roschel, Hamilton, Guilherme G. Artioli, and Bruno Gualano. “Risk of Increased Physical Inactivity During COVID-19 Outbreak in Older People: A Call for Actions.” Journal of the American Geriatrics Society 68, no. 6 (2020): 1126–1128. https://doi.org/10.1111/jgs.16550.

ScotPHN. “What Is a Community Link Worker?” Edinburgh, 2018.

Sepúlveda-Loyola, W., I. Rodríguez-Sánchez, P. Pérez-Rodríguez, F. Ganz, R. Torralba, D.V. Oliveira, and L. Rodríguez-Mañas. “Impact of Social Isolation Due to COVID-19 on Health in Older People: Mental and Physical Effects and Recommendations Recomendaciones.” J Nutr Health Aging 24, no. 9 (2020): 938–947. http://10.0.3.239/s12603-020-1469-2.

Shahid, Zainab, Ricci Kalayanamitra, Brendan McClafferty, Douglas Kepko, Devyani Ramgobin, Ravi Patel,

Chander Shekher Aggarwal, et al. “COVID-19 and Older Adults: What We Know.” Journal of the American Geriatrics Society 68, no. 5 (2020): 926–929. https://doi.org/10.1111/jgs.16472.

Weiss, Robert S. “The Study of Loneliness.” In *Loneliness: The Experience of Emotional and Social Isolation*, First MIT., 7–29. Cambridge, Massachusetts; London, England: The MIT Press, 1975.

World Health Organization. “Archived: WHO Timeline - COVID-19.” News, 2020, accessed July 09, 2021, https://www.who.int/news/item/27-04-2020-who-timeline---covid-19.

World Health Organization. “Coronavirus Disease (COVID-19): How Is It Transmitted?” Questions and Answers, accessed January 20, 2022, 2021. https://www.who.int/news-room/questions-and-answers/item/coronavirus-disease-covid-19-how-is-it-transmitted.

World Health Organization. “COVID-19 - China.” Disease Outbreak News, 2020, accessed April 03, 2020, https://www.who.int/emergencies/disease-outbreak-news/item/2020-DON229.

Xie, Bo, Neil Charness, Karen Fingerman, Jeffrey Kaye, Miyong T. Kim, and Anjum Khurshid. “When Going Digital Becomes a Necessity: Ensuring Older Adults’ Needs for Information, Services, and Social Inclusion During COVID-19.” Journal of Aging and Social Policy 32, no. 4–5 (2020): 460–470. https://doi.org/10.1080/08959420.2020.1771237.

Yang, Yuan, Wen Li, Qinge Zhang, Ling Zhang, Teris Cheung, and Yu Tao Xiang. “Mental Health Services for Older Adults in China during the COVID-19 Outbreak.” The Lancet Psychiatry 7, no. 4 (2020): e19. https://doi.org/10.1016/S2215-0366(20)30079-1.

# THE CITY'S RESPONSE TO A PANDEMIC COVID-19: AN ANALYTICAL STUDY OF THE ROLE OF THE WINDOW IN THE LOCKDOWN STREET, IN COMPARISON WITH "THE PLAGUE" BY ALBERT CAMUS

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## INTRODUCTION

Pandemics and other natural disasters are not a new phenomenon for mankind. Our cities have been affected by pandemics for centuries. To achieve social sustainability, urban planners always focus on high-density development, mixed use, and physically interactive public spaces. Inviting public plazas, mixed-use streets, urban parks, and densely populated residential neighborhoods are just a few aspects of today's sustainable built environment. In terms of pandemics, fear of disease not only restricts physical freedom, but also creates suffocating phobic situations1. It disrupts our previous bonds and creates new ones with the built environment. The virtual connections, which were not very popular among urban planners, have become inevitable means of communication[2]. The unusual circumstances and the reaction of the different social classes to them reveal the new features of the city. Narrative space3 has the ability to bring the different aspects of life onto a single platform and provide a holistic view. A comparative analysis of the current situation of the pandemic and the situation described in "The Plague"4 by Albert Camus is made.

## PRE-PANDEMIC CITY

At the beginning of the pandemics, our streets and houses were taken over by an impalpable force. The uncertainty, the fear of bad events to come at the municipal level, distinguishes pandemics from other disasters that strike without warning and destroy the built fabric of our cities. Pandemics do not destroy built infrastructure5, but hit the psychological and social fabric of the community. Pandemics spread silently in the city through rumors and the sharing of personal stories. News6 about other cities or countries affected by a pandemic on globalized digital and social media platforms brings the pandemic to our cities months before the first case is detected. This virtual presence of the pandemic adds a sensational level of fear that adds a metaphorical depth in tangible, embodied experience, and we begin to look skeptically at places that were once part of our everyday lives. Even the most private and secure place, the "house" understood as "home sweet home," becomes suspect to us. Albert Camus describes this situation in his novel "The Plague", in which he associates boredom with the coming plague. He describes boredom as a mysterious organism in the city of Oran (capital of Algiers) waiting for an event. Camus writes, "*... of a town without pigeons, without any trees or*

*gardens, where you never hear the beat of wings or the rustle of leaves, a thoroughly negative place, in short, Treeless, glamour less, soulless, the town of Oran ends by seeming restful and, after a while, you go complacently to sleep there…"*[7] Fear of disease from touch and breath restricts us not only from close physical interactions with people, but also with places, and our neighborhoods become alien to us. We may notice the inadvertent movements of people in automobiles or pedestrians on the street to overcome the fear of the coming pandemic. Camus writes, *"…For in their aimless walks they kept on coming back to the same streets and usually, owing to the smallness of the town, these were streets in which, in happier days, they had walked with those who now were absent..."*[8] Gradually, day-by-day, the city begins to reveal its secret.

## STREET IN LOCKDOWNS

We experience the city by moving through the streets[9] on foot or by automobiles. These linear enclosures, considered as lounges for the community to stay, thrive on the functions that take place along and within the streets. The integration of these functions defines the character of the streetscape and the facade of the houses becomes the interior space of the street. The residents share this space through doors and windows. Here, the windows not only visually connect the houses, but they also have a metaphorical meaning for the residents and the street users. Lively and bright balconies with flower baskets and seated residents give life to the street. The activities behind the windows and the events on the street are connected to each other on imagination level. The functions within and along the street unanimously form the environment of the street that we experience when we pass through it or stand as spectators through the windows. Around the world, government officials are mostly taking lockdown measures to control the spread of the pandemic and declare a state of emergency. These measures further increase fear of alienation in the run-up to a pandemic. But where lockdowns disrupt our pre-existing ties to the built environment, they form new ones or strengthen the forgotten or weakened ties that allow us to study the street without its previous functions and users. We can find the diverse experiences of a mixed-use street with an open end compared to a residential curly sac street, where most experiences remain the same. The embodied experience is based on our senses, where understanding of space is more dependent upon other senses than visual experience[10].

### Functions and Lockdown Street space

At the beginning of the pandemic, the locked down (lockdown) street was an empty and scaring space haunted by memories of the past and the uncertain future, where space lost its experience except for the physical structure. The visual experience of the street space changed significantly during the lockdowns. In the absence of normal-usual functions, there was event except for the closed shutters of the stores and the carpet road. The urban void created by the absence of shopkeepers and shoppers, babysitters, skateboarding teenagers, residents with their pets, and the presence of dusty cars parked on the side of the street, as well as empty benches, was filled by fast-stepping middle-aged people with shopping bags, delivery boys with online orders, and a few groups of vagabond teenagers. Camus also writes, "*You saw a few children, too young to realize what threatened them, playing in the frosty, cheerless streets"*[11] The uncut branches of the trees, the dry leaves, the growing shrubs and invading fungus on the walls, and the wild flowers in the urban landscape become part of the visual image of the locked down street. We can see more animals (wild and domestic) and birds on the streets reclaiming their space once snatched by man. The presence of homeless people or drug addicts on the ramps of the closed stores or on the empty benches at night is striking. The nights intensify the experience of space where light coming out from the windows was the only sign of life in the streets, which looked like dancing ghosts parallel to the dim shadows on the opposite walls. In the absence of the usual functions, we began to focus more on the built environment. The functions and events that

we habitually associated with a certain part of the streets and time now re-structure themselves under new conditions. We find more eyes behind the windows looking at the street not as spectators but as prisoners than before. The closed and curtained windows at night make the street even more dead. At night, the streets become an eerie space where the passerby must turn his head upward towards windows find life. Here the sky expands to the street scene than on the usual starry nights.

### Sounds and lockdown street space

Visualization cannot give a complete understanding of space without sounds. Sounds connect us to spaces beyond visual connections. Camus writes, "“*Evening was coming on, but the town, once so noisy at this hour still. The only sounds were some bugle-calls echoing through the air…*”[12] After the lockdown, the sounds of nature dominated over the earlier sound patterns[13] we were used to hearing around the clock in our immediate surroundings. The sounds of domestic birds, rodents, insects, and stray cats replace the sounds of the machines, registering their presence at certain times of the day and night[14]. The chirping of the evening sparrows in the empty street of summer tells a different story than the late night hooting of owl. The sounds of the usual household chores and the digital music coming out from the open windows were the only sign of the presence of people on the street. Just as in the midnight hours, the unusual sounds heard when searching for food in the trashcans in the side street remind us of the presence of the forgotten creatures of the city. Walking through the streets, we cannot ignore the presence of dark, silent facades with closed windows and doors that look like corpses. Some times, the sounds of coughing and crying coming from the windows make the experience of the street space even sadder. The piercing siren of an ambulance at night further creates striking waves in the streets. The streets of the commercial districts, where there are more nightclubs, become the quietest places in the city, and the streets leading to hospitals and cemeteries become livelier than ever.

### Odor and lockdown street space

Odor of space also has an important part in defining any space. The fresh air that have odor of vegetation, without dust and the odor of burnt gasoline[15], is the most promising change in the odor of the street space. Before the pandemic, odors played an important role in our orientation. We orient ourselves by walking past businesses with unique odors, such as coffee shops, bakeries, chocolate stores, flower shops, tobacco stores, and perfumeries, to name a few. The hot aura of coffee emanating from the cafes slows our steps in the streets and is no longer part of our daily walk. Camus writes, "*Thousands of roses wilted in the flower-venders' baskets in the market places and along the streets, and the air was heavy with their cloying perfume.*”[16] But during the lockdowns, in the absence of these formal odors, we could not orient ourselves as well as before. The rather musty odor of dark streets, the pungent odor of urine on dark corners becomes apparent. Camus describes the same situation from a different perspective *“...Just before they reached the pier a odor of iodine and seaweed announced the nearness of the sea and they clearly heard the sound of waves breaking gently on the big stone blocks…*”[17] The wetness of rain, the odor of fresh snow and dusty hot air all exaggerate to the pre existing situation. Camus writes from the perspective of the city of Oran, *"... it is the time when silence, sunlight, dust, and pestilence have the streets to themselves*." [18]

### HOUSE IN LOCKDOWNS

At the beginning of the pandemic, the house was the safest place for us, which gradually turns into a suffocated place like a prison. Since the house is a part of the city, it cannot be isolated from the circumstances around it. The experiences we bring from the outside world also haunt our personal spaces. The fear of transmitting disease through touch makes us skeptical and distrustful of our

personal belongings, which disrupt our previous bonds to our shared places. Living in the house round the clock, the fear of outside diseases and the empty streets without events among the fake or real news about pandemics in the social and electronic media are the factors that unanimously turn the house that was once a home sweet home into a pressure cooker that puts our nerves under stress.
It reveals the aspects of our private spaces that were previously hidden, as before the pandemic, the usual cycle of daily functions engaged our selves to certain parts of our home in terms of time spent, but lockdown disrupt that routine and we reschedule our activities[19].

## WINDOWS AS A MEDIATOR BETWEEN STREET AND HOUSE

By connecting the outdoor space round the clock, windows play an important role in defining our understanding of a particular place. Windows have the basic functions of providing ventilation, day lighting, and a view of the exterior[20]. We can add metaphorical meanings by composing and designing these functions within a specific time frame. Despite the great involvement of electronic and social media in our daily lives, windows become an important source of legible interaction with the outside world during lockdown. Here, windows are not only a source of light and ventilation, but they become a sign of freedom and hope. We can see more people looking out onto the street in anticipation of the unknown than before.
Camus discusses this relationship between windows and people, "…*When off duty, he spent most of the time seated in a corner beside the window gazing meditatively at the passers-by, his enormous hands splayed out on his thighs."*[21] The windows, which remained closed and covered with heavy curtains because of the polluted air and automobile noise on Mix-used Street, become an important part of the interior space during the lockdown, bringing unfamiliar views, pleasant light, sounds, and odors into the house, providing a sense of discovery and creating new connections between the residents and their adjacent environment. Under the deep blue sky, the chirping of birds in the early morning, the light air with the scent of fresh vegetation that becomes heavier in the evening when you wait all day for good news are the transformations, which were not a part of our usual and cyclic life. Camus writes the same situation: *"...Keep watching out side whole day reveal the light as colors. The light on the whitewashed walls was changing from pink to yellow. The first waves of another day of heat were beating on the windows…"*[22] The early morning religious calls to prayer, such as the ringing of church and temple bells or the azans[23] of mosques, now have a more concrete presence in our interiors. These signs of faith have entered the home through the windows, connecting the mortal with the immortal. Christian Nobel Schulz quotes Heidegger's words " the tolling of the evening bell brings men, as mortals, before the Divine" in his book "Genius Loci: Towards a Phenomenology of Architecture".[24]
The clanking of the ambulance brings the dying through the windows into our houses metaphorically placing us in a feeble state of isolation. *"...People living in the central districts realized that their turn had come when each night they heard oftener and oftener the ambulances clanging past, sounding the plague's dismal, passionless tocsin under their windows..."*[25] another place Camus writes*"...and soon the ambulance could be heard clanging down the street. (At first the neighbors used to open windows and watch. Later they promptly shut them..."*[26] The back windows become less important and remain closed as the absence of human activity significantly increased the presence of stray cats, dogs, and rodents, driving the back street further into isolation. Camus writes, *"...As he was driving down a back street redolent of fried fish and urine, a woman screaming in agony…"*[27] The sounds of domestic affairs from neighboring windows were another addition that had previously been occasional. The cyclical rotation of events forces us to stare into space and take refuge in memories in the shadow of the uncertain future. The silent and stagnant commercial functions on the first floor also affect the apartments on the upper floors. The sense of alienation intensifies at night, when only the

streetlights on the empty street and the benches under the dim yellow lights look as if they are waiting for ghosts. In words of Camus "*That evening she was gazing out of the window at the now empty street. ... And only at long intervals a lamp cast flickering gleams through the thick darkness of the town."* [28]

## TRANSFORMATION OF LOCK DOWN STREET INTO LOUNGE

Man is considered a social animal with the ability to adapt to his environment and transform the environment according to his physical or mental needs. The unusual circumstances of pandemic and lockdown force us to find new solutions. We observe the theatrical use of windows and streets, where the type and strategic location of the windows play an important role. The internal restlessness of the house and in the absence of outdoor human activity enforces the residents to talk, sing and play on musical instruments on a communal level. The windows with balconies become stages for singing and music, and the windows without balconies become spectator galleries. The lockdown provides a peaceful and quiet environment suitable for performances. Parallel to the bad circumstances, these communal unusual celebrations on the street give a festive memory of the lock down space. The balconies or terraces of corner buildings and urban U- and T-shaped enclosures, where performers have maximum visual contact, become informal cultural sites that elevate the soles of residents. Low-roofed (two to three floors) buildings surrounded by sixth- or eighth-story buildings provide the perfect arena for performances. This enclosure adds an additional eco-element to the space, essential for creating a sense of unity. There is a great transformation in the volumetric experience of the lockdown streets, where void created by the absence of the usual functions exaggerate the sense of scale and creates a new kind of bond between people and the built environment. Many streets are transformed into places of prayer yards, especially in Islamic countries where Muslims perform five prayers a day. The street as a place of prayer establishes a spiritual connection where the street becomes a bridge between mortals and immortals. Religious practices and processions in the street have greater symbolic significance on an urban scale than confinement within a building. These gatherings also demonstrate the territorial claim and ownership of a particular ethnic or religious group on a communal level. Physical rituals during prayers, such as standing, sitting, and bowing one's forehead on the ground in the middle of the street, are just a few aspects of the unusual street experience. Discussing current issues and sharing personal stories in the middle of the street while waiting in queues outside the grocery stores and banks creates a new kind of social interaction.

## CONCLUSION

After analyzing the city's response to Covid-19 and comparing it to the plague situation described in " The Plague" by Camus, it is obvious that despite the great differences between the city today and the city described by Camus, the city's response to the pandemic is the same, i.e. self-healing process of the urban fabric. The void of leftover functions or events in urban fabric is always filled by as part of the natural healing process. This process provokes our senses to reach the hidden perspectives of the public-private spheres[29]. Lockdowns reveal the inefficiency of contemporary urban design, where we can observe people reclaiming their space from machines alongside animals or birds.

## NOTES

[1] Lindsay J. McCunn  The importance of nature to city living during the COVID-19 pandemic: Considerations and goals from environmental psychology, (Cities & Health, 2020), DOI: 10.1080/23748834.2020.1795385
[2] Ward, Meredith C. 2021. “The Sounds of Lockdown: Virtual Connection, Online Listening, and the Emotional Weight of COVID-19”. Sound Effects - An Interdisciplinary Journal of Sound and Sound Experience 10 (1): 7-26. https://doi.org/10.7146/se.v10i1.124195.
[3] Nigel Coates, Narrative Architecture: Architectural Design Primers series (New Jersey: Wiley, 2012), 132.
[4] Albert Camus, Plague (Penguin Books, Limited, 2020)
[5] Ming Hu et al., "The role of built and social environmental factors in Covid-19 transmission: A look at America’s capital city," *Sustainable Cities and Society*, November 2020, https://doi.org/10.1016/j.scs.2020.102580.
[6] Int. J. Res. Pharm. Sci. ; Special Issue 1(11): 171-174, 2020. Artigo em Inglês | WHO COVID, ELSEVIER | ID: covidwho-655681
[7] Camus, The Plague, 1.
[8] Camus, The plague, 34.
[9] Kevin Lynch, *Image of the city* (Massachusetts: MIT Press, 1960)
[10] Juhani Pallasmaa, Eyes of the Skin: Architecture and the Senses (Wiley & Sons, Limited, John, 2012)
[11] Camus, The Plague, 127.
[12] Camus, The Plague, 41.
[13] César Asensio, Ignacio Pavón, and Guillermo de Arcas, "Changes in noise levels in the city of Madrid during COVID-19 lockdown in 2020," Journal of the Acoustical Society of America 148, no. 3 (September 2020): https://doi.org/10.1121/10.0002008.
[14] Jerónimo Vida Manzano et al., "The “sound of silence” in Granada during the COVID-19 lockdown," Noise Mapping 8, no. 1 (January 2021): https://doi.org/10.1515/noise-2021-0002.
[15] Guilherme Dantas et al., "The impact of COVID-19 partial lockdown on the air quality of the city of Rio de Janeiro, Brazil," Science of The Total Environment 729 (August 2020): https://doi.org/10.1016/j.scitotenv.2020.139085.
[16] Camus, The Plague, 32.
[17] Camus, The Plague, 125.
[18] Camus, The Plague, 59.
[19] Nicola Cellini et al., "Changes in sleep pattern, sense of time and digital media use during COVID-19 lockdown in Italy," Journal of Sleep Research 29, no. 4 (May 2020): https://doi.org/10.1111/jsr.13074.
[20] Ayesha Batool, Peter Rutherford, Paul McGraw, Timothy Ledgeway & Sergio Altomonte (2021) Window Views: Difference of Perception during the COVID-19 Lockdown, LEUKOS, 17:4, 380-390, DOI: 10.1080/15502724.2020.1854780
[21] Camus, The Plague, 40.
[22] Camus, The Plague, 105.
[23] Islamic way of calling the citizens for prayer.
[24] Christian Norberg-Schulz, Genius Loci (Rizzoli, 1991), 7
[25] Camus, The Plague, 82.
[26] Camus, The Plague, 44.
[27] Camus, The Plague, 26.
[28] Camus, The Plague, 60.
[29] Ali Madanipour, Public and private spaces of the city (New York, NY: Routledge, 2003)

## BIBLIOGRAPHY

Carpenter, Edmund Snow. *Eskimo Realities*. New York: Holt, Rinehart and Winston, 1973.
Düttmann, Alexander Garcia. *Philosophy of Exaggeration*. Translated by James Philips. New York: Continuum, 2007.
Havik, Klaske. *Urban literacy: Reading and Writing Architecture*. Rotterdam: nai010, 2015.
Holl, Steven, Juhani Pallasmaa and Alberto Perez-Gomez. *Questions Of Perception: Phenomenology Of Architecture*. San Francisco: William K Stout, 2007.

Lefebvre, Henri. *The Production of Space*. Translated by Donald Nicholson-Smith. New Jersey: Wiley-Blackwell, 1992.

Madanipour, Ali. *Public and private spaces of the city*. Abington: Routledge, 2003.

Merleau-ponty, Maurice. *The visible and the invisible: studies in phenomenology and existential philosophy*. Illinois: Northwestern University press, 1968.

Pallasmaa, Juhani. *The Thinking Hand: Existential and Embodied Wisdom in Architecture*. New Jersey: Wiley, 2009.

Psarra, Sophia, *Architecture And Narrative*. Abington: Routledge, 2009.

Pallasmaa, Juhani. *The Eyes of the Skin: Architecture and the Senses*. New Jersey: Wiley, 2012.

Sobchack, Vivian and John Beckmann. “Seeing with your eyes” In *Virtual Dimension: Architecture, Representation, and Crash Culture***,** edited by John Beckmann, 343-355. New York: Princeton Press, 1998.

Smithson, Alison. *The Charged Void: Urbanism. New York*: Mona celli Press, 2005.

Spurr, David. *Architecture and Modern literature. Michigan*: University of Michigan press, 2012.

Tschumi, Bernard. *Architecture Concepts: Red Is Not A Color*. New York: Rizzoli, 2012.

Fioretti, Chiara, Benedetta Emanuela Palladino, Annalaura Nocentini, and Ersilia Menesini. "Positive and Negative Experiences of Living in COVID-19 Pandemic: Analysis of Italian Adolescents’ Narratives." Frontiers in Psychology 11 (November 2020)

Loh, Hong Chuan, Irene Looi, Alan Swee Hock Ch’ng, Khang Wen Goh, Long Chiau Ming, and Kean Hua Ang. "Positive global environmental impacts of the COVID-19 pandemic lockdown: a review." GeoJournal, July 2021. https://doi.org/10.1007/s10708-021-10475-6.Martínez, Lina, and John Rennie Short. "The Pandemic City: Urban Issues in the Time of COVID-19." Sustainability 13, no. 6 (March 2021): 3295.https://doi.org/10.3390/su13063295.

Probst, Thomas, Sanja Budimir, and Christoph Pieh. "Depression in and after COVID-19 lockdown in Austria and the role of stress and loneliness in lockdown: A longitudinal study." Journal of Affective Disorders 277 (December 2020): 962–63. https://doi.org/10.1016/j.jad.2020.09.047.

Russell, Wendy, and Alison Stenning. "Beyond active travel: children, play and community on streets during and after the coronavirus lockdown." Cities & Health, August 2020, 1–4. https://doi.org/10.1080/23748834.2020.1795386.

Jasprica, Nenad, and Milenko Milović. "Flora of the cobbled streets and pavements in the Mediterranean Old City of Dubrovnik during the COVID-19 lockdown." Natura Croatica 29, no. 1 (October 2020): 19–28. https://doi.org/10.20302/nc.2020.29.3.

# THE CORRELATION BETWEEN DISTANCE INTO LONDON'S PARKS AND NITROGEN DIOXIDE EXPOSURE

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## INTRODUCTION

Nitrogen Dioxide ($NO_2$) is produced when fossil fuels including coal, oil, gas or diesel are burned at high temperatures.[1] $NO_2$ is produced by cars, boilers and power plants[2] and measured in micrograms per cubic metre ($\mu g/m^3$). Road traffic is the single greatest contributing factor to $NO_2$ levels outdoors.[3] $NO_2$ levels in the United Kingdom (UK) have dropped over the past 50 years due to regulations limiting $NO_2$ emissions.[3] The most significant reductions in the UK have been seen in the amount of $NO_2$ produced by power stations and road transport. It is thought that in more recent years, reductions in travel due to COVID-19 have further reduced $NO_2$ produced by road traffic.[4]

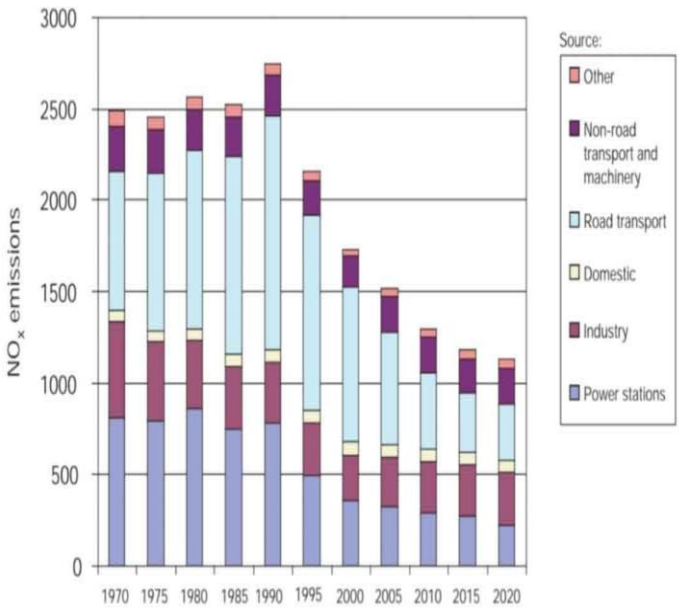


*Figure 1. $NO_x$ (Nitrogen Dioxide and Nitrogen Oxide) Emissions in Kilotons in the UK by Source from 1970 to 2020 by Air Quality Expert Group*

In 2010, the UK government established two objectives related to $NO_2$ levels. This includes an hourly objective of 200 $\mu g/m^3$ $NO_2$ and an annual limitation of 40 $\mu g/m^3$ $NO_2$.[5] Meanwhile, the World Health

Organization's (WHO) guidelines indicate there should be no more than a 10 μg/m$^3$ $NO_2$ annual mean and 25 μg/m$^3$ $NO_2$ 24-hour mean in any given location.[6]
In a number of London locations, annual mean $NO_2$ readings taken in 2016 by The London Air Quality Network exceeded both the UK government and WHO thresholds. $NO_2$ levels of 113 μg/m$^3$ were found at Marble Arch, 142 μg/m$^3$ at Trafalgar Square and 169 μg/m$^3$ at Marylebone Flyover. Numerous locations exceed the hourly mean thresholds.

| Location | Hourly Mean $NO_2$ (μg/m$^3$) |
|---|---|
| Bexley | 4 |
| Bloomsbury | 10 |
| Camden | 27 |
| Eltham | 11 |
| Haringey Roadside | 26 |
| Harlington | 6 |
| Hillingdon | 24 |
| Marylebone Road | 59 |
| North Kensington | 5 |
| Southwark Old Kent Road | 10 |
| Tower Hamlets Roadside | 13 |
| Westminster | 10 |

*Table 1. Readings Taken by UK Air in 2021 Show a Range of $NO_2$ Levels in London*

London is not alone in producing high levels of $NO_2$. While an average monthly reading of 30.2 μg/m$^3$ $NO_2$ was found in London in 2021,[4] during this same time, readings in Paris averaged 43.1 μg/m$^3$ $NO_2$ and 27.3 μg/m$^3$ $NO_2$ in Rome. In cities worldwide, annual mean concentrations are between 20 and 90 μg/m$^3$ $NO_2$.[1] In the United States it has been documented that $NO_2$ levels are highest in areas with the highest populations.[1]

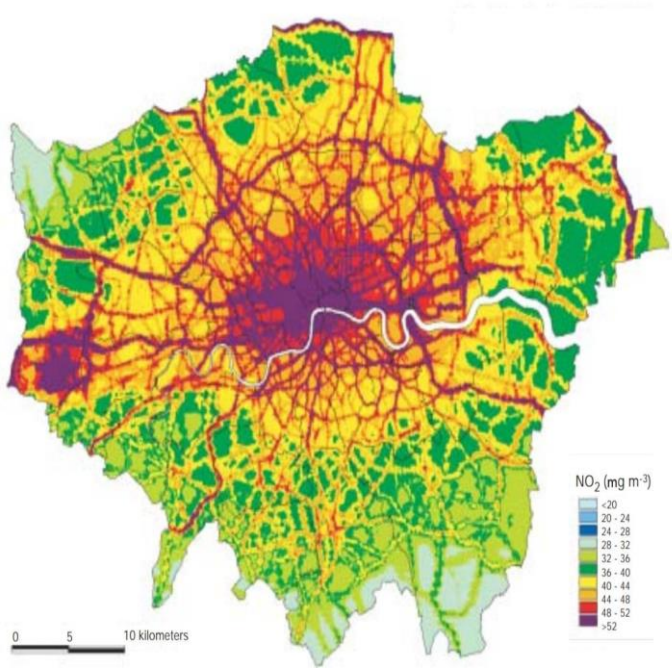


*Figure 2. Nitrogen Dioxide Levels in London in 1999 by Air Quality Expert Group*

### Nitrogen dioxide levels on uk roads

In 2020 it was found that $NO_2$ levels along roads in the UK follow a consistent pattern during the course of a week.[7] Both urban background and roadside $NO_2$ concentrations peaked Wednesday to Friday and dropped on the weekend. For roadside sites, the $NO_2$ level was 46% greater on the weekdays when compared to the weekends. It was speculated this was due to a drop in vehicular traffic.

### Health implications of nitrogen dioxide exposure

While short-term exposures to low levels of $NO_2$ have limited impact on health, studies on animals demonstrated health impacts of high levels of $NO_2$ or prolonged exposure.[1] Generally, these impacts are seen when the exposure takes place over weeks or months.[1] High $NO_2$ levels affect the lungs. The effects include inflammation, cough, and reduced function of the lungs[1] as well as an individual's ability to fight respiratory infections.[8] $NO_2$ can cause asthma in children. Chen, Gokhale, Shofer, Kuschner concluded, "$NO_2$ exposure may increase the risk of respiratory tract infections through the pollutant's interaction with the immune system." Those already suffering from heart and lung conditions can experience increased symptoms when exposed to $NO_2$.[9]

A study out of Japan found a 2.28 elevated risk for those residing in areas with a $NO_2$ level in the range of 60-70 $\mu g/m^3$ when compared to those residing in areas with $NO_2$ levels between 40 to 50 $\mu g/m^3$.[1] Further, a study out of Germany found reduced airway responsiveness of children living in areas with 49 $\mu g/m^3$ when compared to those in areas with $NO_2$ levels of 25 $\mu g/m^3$.[1] The 1993 Children's Health Study out of Los Angeles found a correlation between long term exposure to air pollution and multiple measures of pulmonary health.[10]

Faustini, Rapp and Forastiere conducted a meta-analysis into the effects of a 10 $\mu g/m^3$ increase in $NO_2$. They examined the findings of 23 studies conducted between 2004 and 2013. Faustini, Rapp and Forastiere found an effect of 1.04 on mortality, 1.03 on respiratory mortality, and 1.13 on cardiovascular mortality.[11]

When examining trends in Europe, a 10 μg/m$^3$ increase in $NO_2$ is associated with a 7% increase in mortality. [11]

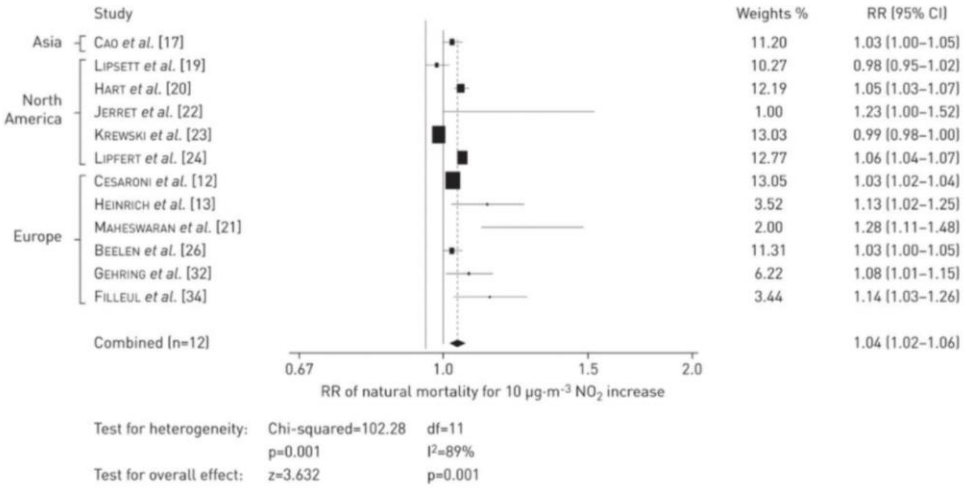


*Figure 3. Increase in Mortality for an Increase of 10 μg/m$^3$ of Nitrogen Dioxide by Annunziata Faustini, Regula Rapp and Francesco Forastiere*

## Parks and green spaces

In 2019 a group led by Dr. Mathew White, Senior Lecturer in Environmental Psychology at the European Centre for Environment & Human Health, recommended everyone spend two hours a week in parks.[12] Dr. White concluded two hours a week in parks can "lower a person's stress levels, decrease blood pressure and reduce the risk of asthma, allergies, diabetes and cardiovascular disease, while boosting mental health and increasing life expectancy." Doctors in South Dakota began prescribing time outside in 2017, and now many doctors in the United States prescribe time outdoors.[13]

With over 3,000 green spaces, 18 percent of London land is used as parks.[14] In total there are approximately 282 square kilometers of green space in London. The Mayor of London, Sadiq Khan, aims to make over half of London green by 2050.[14]

Other major cities range from 2.2% green space in Istanbul to Oslo at 68%. Oslo, with the greatest percentage of green space, has $NO_2$ levels ranging from 10 μg/m$^3$ to 26 μg/m$^3$. In contrast, Istanbul, with the smallest percentage of green space, has levels ranging from 30 μg/m$^3$ to 107μg/m$^3$.[15]

In 2019, researchers from Imperial College London and The University of Leicester found that over a quarter of parks didn't meet international $NO_2$ thresholds. "24% of play spaces, 67% of private parks and 27% of public parks had average levels of $NO_2$ that exceeded the EU limit for $NO_2$ [40 μg/m$^3$]."[16]

## METHOD

Ten London Parks were selected for this study. Parks were selected for a larger size in comparison to other London parks as well as those with a location near roads with significant vehicular traffic. Points were identified along the perimeter of each park, with a distance of 200 metres between points. 2016 London Air Quality Network $NO_2$ maps are the most current. These were gathered for each of the ten identified parks. The $NO_2$ level of each of the perimeter points was identified and a numerical value was assigned based upon the colour coding of the map. By overlaying a Google Earth map and using the ruler tool, the minimum distance required to achieve a 10 μg/m$^3$ decrease in $NO_2$ was recorded. Determinations were made regarding specific locations to exclude (see below). The values

for each park were averaged to determine a mean value for the park. Values for all parks were averaged to find a mean value for all parks.

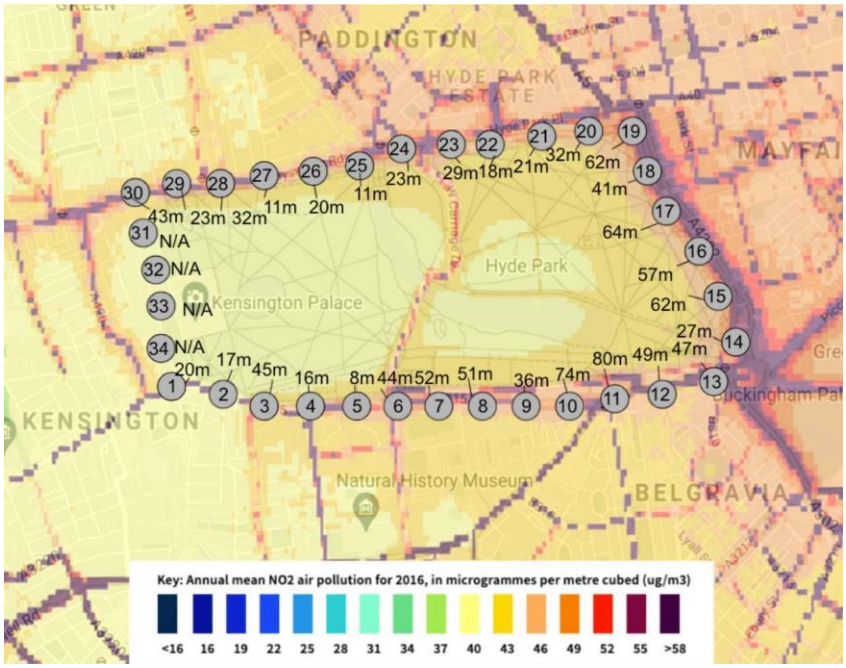


*Figure 4. The Distance Required to Achieve a 10 µg/m³ Decrease in $NO_2$. Original image from London Air Quality Network. Annotations created during research.*

## Excluded data

The common traffic pattern of vehicle flow along the perimeter of a park is seen in parks within and outside of London. Throughout the study, only portions of parks that included vehicular roadways along the perimeter were included. For instance, a perimeter piece on the northern side of Battersea Park was excluded. This side of the park is bordered by the Thames River.

## RESULTS

The mean distance for ten selected London parks was analyzed. For 75% of data examined, the distance from the perimeter of the park to a point within the park with a $NO_2$ level 10 µg/m$^3$ less than that found at the perimeter was 65 meters.

Within the parks studied, the three parks with the greatest distance required from the park perimeter to a location with a 10 µg/m$^3$ decrease in $NO_2$ readings are in the boroughs of Westminster and Wandsworth. Both Regents Park and Green Park are located in Westminster while Battersea Park is located in Wandsworth. Regents Park had the highest average distance required between the park perimeter and a location with a 10 µg/m$^3$ decrease in $NO_2$ readings. This was 103.9 metres for Regents Park. In Green Park 76.9 metres were required to experience the 10 µg/m$^3$ decrease in $NO_2$ readings. In general, larger roads along the perimeter of the park produced higher $NO_2$ levels.

Conversely, Raven's Court Park in Hammersmith and Fulham had the lowest average distance with a distance of 22.8 metres between the perimeter and a 10µg/m$^3$ decrease in $NO_2$ levels. Kennington Park in Lambeth required a distance of 27.1 metres between the perimeter and a 10µg/m$^3$ decrease in $NO_2$ levels. Finsbury Park in Haringey required a distance of 29.3 metres to experience the 10 µg/m$^3$ drop in $NO_2$ values.

Exceptions to the data examined included the south side of Wormwood Scrubs in Hammersmith and Fulham and the west side of Kensington Gardens in Westminster. For both locations the readings

along the perimeter of the parks were already within 10 μg/m$^3$ of the areas without traffic in that area. The limited vehicular traffic in these areas allows the $NO_2$ level to remain aligned with local areas not exposed to traffic.

## IMPLICATIONS

Frequent users of London parks currently experience regular exposure to toxic $NO_2$ levels. High levels of air intake are expected as park users are often exercising and breathing at a higher rate. Users of urban parks are often those living near the park and visit the same park repeatedly. Children are particularly susceptible when they are taken to a local park located in an area with toxic levels of $NO_2$. Prolonged and repeated exposure places park users at increased risk for a number of health factors, including inflammation, cough, and reduced function of the lungs.[17] It also increases overall chances of mortality.[11]

A decrease of 10 μg/m$^3$ of $NO_2$ has been identified as decreasing mortality. For seventy-five percent of locations, a separation of 65 metres between vehicular roads and a location within a park is enough to experience this 10 μg/m$^3$ difference in $NO_2$ levels. There are a number of ways in which this differential can be achieved.

### Changes to park design

The reduction of $NO_2$ by 10 μg/m$^3$ has an impact on human health. For seventy-five percent of locations, moving 65 metres into a London park reduces the $NO_2$ level by 10 μg/m$^3$. Relocating park users at least 65 metres into a park as quickly as possible and for as much of their park experience as possible maximizes the amount of time the park user experiences a reduced $NO_2$ exposure. The design of new parks and redesign of existing parks need to account for the air quality of urban areas, particularly those near congested streets.

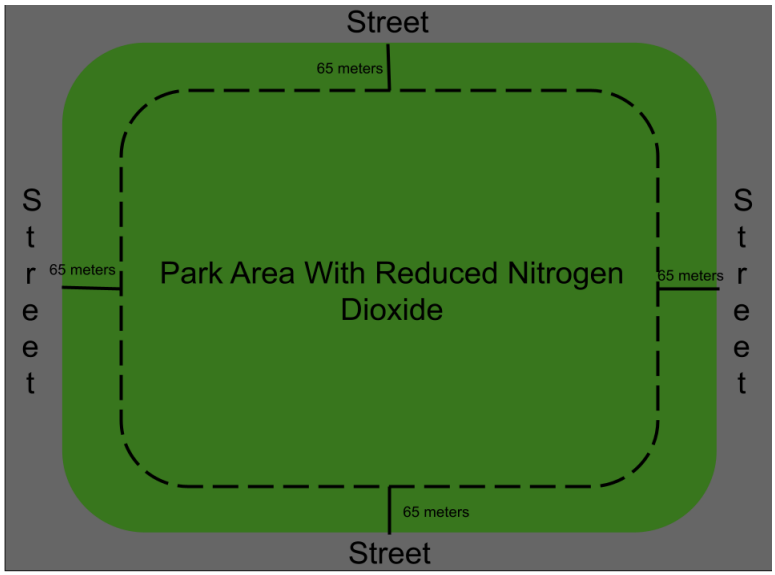


*Figure 5. Example Park Design*

The first implication of these findings applies to those using the sidewalks. Walking paths should be designed to quickly bring people at least 65 metres into parks. For instance, along the south side of Hyde Park and Kensington Gardens in Westminster, many paths currently parallel the perimeter street and are located less than 20 metres from the street. These paths would be better situated if short paths brought park goers 65 metres directly into the park.

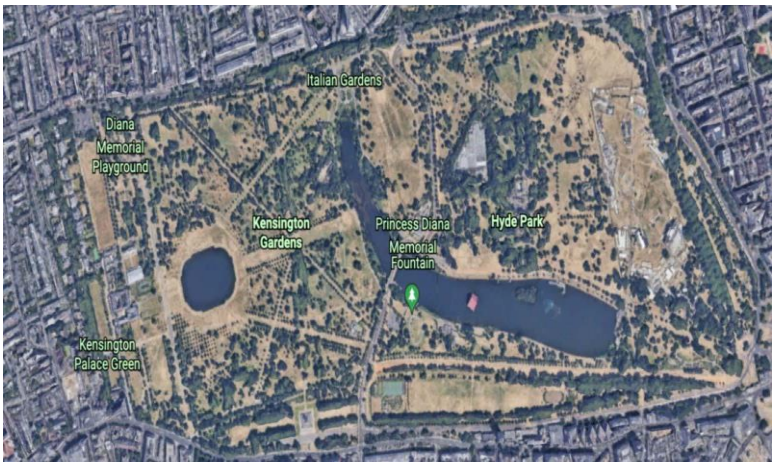


*Figure 6. Hyde Park and Kensington Gardens Including Walking Paths. Image by Google Earth*

The next application of these findings benefits those using play spaces and outdoor park features. These play spaces and outdoor features should be built in excess of 65 metres from the park perimeter. For example, Princess Diana Playground in Kensington Gardens is situated along the north edge of the park. The $NO_2$ readings in this area are 52 $\mu g/m^3$. If this playground were situated 65 metres into the park, users would benefit from a 12 $\mu g/m^3$ difference in $NO_2$ levels.[18]
Similarly, Kennington Park Hockey Field is located near the park perimeter. The nearby road has $NO_2$ levels of 52 $\mu g/m^3$. In the current location, the hockey field experiences $NO_2$ levels of 49 $\mu g/m^3$. Relocating the hockey field 65 metres into the park would allow field users to experience a reduction of 12 $\mu g/m^3$ of $NO_2$ from the perimeter road, with $NO_2$ levels at 40 $\mu g/m^3$.[18] The current location allows for only a 3 $\mu g/m^3$ decrease from the perimeter road level.

## Sources of Emissions

An alternative to changing park design is to move the key contributors of $NO_2$ emissions further from parks. London and larger cities currently have plans to reduce $NO_2$ emissions, but these are not focused on air quality within parks.

### Royal Parks Initiative

Reducing traffic in the Royal Parks is not new. In August 2020 measures were introduced to reduce traffic.[19] This was a measure introduced during COVID-19 as park goers expressed an interest in seeing fewer cars as they increased their use of parks.

| Park | People who support making road closure trials permanent (percentage)[19] |
|---|---|
| Greenwich Park | 81 |
| St. James Park | 79 |
| Hyde Park | 74 |
| Richmond Park | 71 |
| Bushy Park | 56 |

*Table 2. Percent of People who Support Making Royal Parks Road Closure Trials Permanent*

Some measures introduced by the Royal Parks Initiative applied only at specified times. This included a trial of eliminating weekend traffic on The Mall in St. James Park and South Carriage Drive in Hyde Park (both parks in Westminster), on the weekends. Richmond Park has closed some roads permanently, others on weekends and others on holidays.

In 2021, Andrew Scattergood, The Royal Parks' Chief Executive, said, "London's green spaces are vital refuges where people can come to escape from the busy city, and never has this been more apparent than over the past 12 months. These trials have proved that there is support from park visitors to limit cut-through traffic and create car-free spaces, where people can enjoy spending time in the natural environment to boost their health and happiness."[19]

In general, the traffic reductions in the Royal Parks are focused on weekends. To have the greatest impact on air quality, they need to be implemented on weekdays.

### Ultra Low Emission Zone

The Ultra Low Emission Zone (ULEZ) was introduced in parts of London in October 2021 by London Mayor Sadiq Khan.[20] This zone surrounds central London. Those driving polluting vehicles in the ULEZ zone are fined £12.50 per day.[20] For cars and vans, a polluting vehicle is any petrol vehicle which doesn't meet the Euro 4 standard of less than 0.08g/km of $NO_x$. For diesel vehicles, the Euro 6 standard of less than 0.08g/km of $NO_x$ is applied.[21] In 2019, it is estimated that 74% of vehicles in the ULEZ were compliant.[22]

### Crit'Air Model

Crit'Air was introduced within several larger cities in France in 2016. Paris, Lyon, Grenoble, Lille, Strasbourg, Toulouse, Chambery, and Marseille utilise Crit'Air.[23] Within this system, vehicle owners display a colour-coded sticker on their windshields. The sticker colour corresponds to the vehicle's pollution level. The current level of air quality determines those allowed to drive in the city. Those not complying are fined up to 135 Euros.[24]

## RECOMMENDATION

An adaptation of either ULEZ or Crit'Air could contribute to healthier London parks, as could furthering the Royal Parks Initiative to include weekdays. The parks with the highest levels of $NO_2$ are those located near large roads. Creating a ULEZ route around each of London's ten largest parks could effectively create a distance of 65 meters between the perimeter of the park and the nearest road. Or, as is done in parts of France, use of real-time monitoring devices could be placed along the perimeters of the ten large parks. When $NO_2$ levels exceed UK and WHO guidelines, the road along park perimeters could be closed to those with petrol vehicles exceeding the Euro 4 Standard and diesel vehicles exceeding the Euro 6 standard.

## ACKNOWLEDGEMENT

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## NOTES

[1]World Health Organization, Air Quality Guidelines for Europe (WHO Regional Office for Europe, 2000), accessed August 20, 2021,
https://www.euro.who.int/__data/assets/pdf_file/0017/123083/AQG2ndEd_7_1 nitrogendioxide.pdf.
[2]"Basic Information about NO2," United States Environmental Protection Agency, accessed August 5, 2021, https://www.epa.gov/no2-pollution/basic-information-about-no2.
[3]Department for Environment, Food and Rural Affairs, "Nitrogen Dioxide in the United Kingdom," news release, 2004, accessed July 29, 2021, https://uk-air.defra.gov.uk/library/assets/documents/reports/aqeg/nitrogen _dioxide_in_the_UK-summary.pdf.
[4]Department for Environment, Food and Rural Affairs, "Nitrogen Dioxide."
[5]Ian Tiseo, "Monthly Concentration of Nitrogen Dioxide in Select European Cities 2019-2021," Statista, last modified November 23, 2021, accessed November 30, 2021, https://www.statista.com/statistics /1185973/ no2-concentrations-in-select-cities-in-europe-covid-19/.
[6]"Concentrations of Nitrogen Dioxide," UK Government, accessed August 13, 2021,
https://www.gov.uk/government/statistics/air-quality-statistics/ntrogen-dioxide.
[7]"Ambient (Outdoor) Air Pollution," World Health Organization, last modified September 22, 2021, https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health.
[8].Tiseo, "Monthly Concentration," Statista.
[9]World Health Organization, Air Quality, 3-4.
[10]World Health Organization, Air Quality, 1.
[11]"Technical Report on UK Supplementary Assessment under The Air Quality Directive (2008/50/EC), The Air Quality Framework Directive (96/62/EC) and Fourth Daughter Directive (2004/107/EC) for 2019," UK Air, last modified December 23, 2021, accessed December 21, 2021, https://uk-air.defra.gov.uk/assets/documents/ reports/cat09/2102111100_2019_PCM_technical_report.pdf.
[12]World Health Organization, Air Quality, 21.
[13]World Health Organization, Air Quality, 22.
[14]World Health Organization, Air Quality, 3.
[15]Stanley V. Dawson and Marc B. Schenker, "Health Effects of Inhalation of Ambient Concentrations of Nitrogen Dioxide," American Review of Respiratory Disease 120, no. 2: 281, accessed August 13, 2021, https://www.atsjournals.org/doi/abs/10.1164/arrd.1979.120.2.281.
[16]Tze-Ming Chen et al., "Outdoor Air Pollution: Nitrogen Dioxide, Sulfur Dioxide, and Carbon Monoxide Health Effects," abstract, American Journal of the Medical Sciences 333, no. 4 (April 1, 2007): 249-256, accessed September 3, 2021, https://doi.org/10.1097/MAJ.0b013e31803b900f.
[17]World Health Organization, Air Quality, 24.
[18]World Health Organization, Air Quality, 24.
[19]Zhanghua Chen et al., "Chronic Effects of Air Pollution on Respiratory Health in Southern California Children: Findings from the Southern California Children's Health Study," Journal of Thoracic Disease, 46, accessed September 5, 2021, https://doi.org/10.3978/j.issn.2072-1439.2014.12.20.
[20]Annunziata Faustini, Regula Rapp, and Francesco Forastiere, "Nitrogen Dioxide and Mortality: Review and Meta-analysis of Long-term Studies," European Respiratory Journal 44, no. 3 (February 20, 2014): 744, https://doi.org/10.1183/09031936.00114713.
[21]Faustini, Rapp, and Forastiere, "Nitrogen Dioxide," 744.
[22]Mathew P. White et al., "Spending at Least 120 minutes a Week in Nature Is Associated with Good Health and Wellbeing," Scientific Reports 9, no. 1 (June 13, 2019), accessed August 20, 2021, https://doi.org/10.1038/s41598-019-44097-3.
[23]Tik Root, "Doctors Are Prescribing Park Visits to Boost Patient Health," National Geographic, last modified June 29, 2017, accessed December 20, 2021, https://www.nationalgeographic.com/science/article/parks- prescribes-doctors-health-environment.
[24]"Parks and Green Spaces," Mayor of London, accessed August 30, 2021, https://www.london.gov.uk/what-we-do/environment/parks-green-spaces-and-biodiversity/parks-and-green-spaces.
[25]"Parks and Green," Mayor of London.
[26]Selahattin Incecik and Ula Im, "Air Pollution in Mega Cities: A Case Study of Istanbul," Air Pollution - Monitoring, Modelling and Health, March 23, 2012, accessed December 19, 2021, https://doi.org/10.5772/32040.

[27]Charlotte E. Sheridan et al., "Inequalities in Exposure to Nitrogen Dioxide in Parks and Playgrounds in Greater London," International Journal of Environmental Research and Public Health 16, no. 17 (September 1, 2019)], August 3, 2021, https://doi.org/10.3390/ijerph16173194.
[28]"Nitrogen Dioxide," American Lung Association, last modified February 12, 2020, accessed August 10, 2021, https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/nitrogen-dioxide.
[29] Faustini, Rapp, and Forastiere, "Nitrogen Dioxide," 744.
[30]"Annual Pollution Maps," London Air, accessed August 15, 2021, https://www.londonair.org.uk/london/asp/ annualmaps.asp.
[31]"Annual Pollution," London Air.
[32]"The Royal Parks' Traffic Reduction Measures to Remain in Place for Another Year," The Royal Parks, last modified March 9, 2021, accessed December 21, 2021, https://www.royalparks.org.uk/media-centre/ press-releases/the-royal-parks-traffic-reduction-measures-to-remain-in-place-for-another-year.
[33."]"The Royal," The Royal Parks.
[34 ]"The Royal," The Royal Parks.
[35]"The Mayor's Ultra Low Emission Zone for London," Mayor of London, accessed August 29, 2021, https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/mayors-ultra-low-emission-zone-london.
[36]"The Mayor's," Mayor of London.
[37]"Euro 1 to Euro 6 Guide – Find out Your Vehicle's Emissions Standard," Royal Automobile Club, last modified February 6, 2020, accessed December 20, 2021, https://www.rac.co.uk/drive/advice/emissions/ euro-emissions-standards/.
[38]"First Month of Mayor's ULEZ Sees 74 per cent of Vehicles Comply," Mayor of London, last modified May 16, 2019, accessed September 5, 2021, https://www.london.gov.uk/press-releases/mayoral/almost-three-quarters -complying-with-new-standards.
[39]"Certificats Qualité de l'air : Crit'Air," Ministère de la Transition Écologique, accessed December 20, 2021, https://www.ecologie.gouv.fr/certificats-qualite-lair-critair#e5.
[40]"Crit'Air New Regulations in France," Alphabet, accessed December 20, 2021, https://www.alphabet.com /files/crit%27air-management-briefing---almar-052.3.pdf.

## BIBLIOGRAPHY

"About the Breathe London Network." Breathe London. Accessed August 13, 2021. https://www.breathelondon.org/about.
"Air Pollution in Europe: Real-time Air Quality Index Visual Map." World Air Quality Index. Accessed August 29, 2021. https://aqicn.org/map/europe/.
"Ambient (Outdoor) Air Pollution." World Health Organization. Last modified September 22, 2021. https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health.
"Annual Pollution Maps." London Air. Accessed August 15, 2021. https://www.londonair.org.uk/london/asp/ annualmaps.asp.
"Basic Information about NO2." United States Environmental Protection Agency. Accessed August 5, 2021. https://www.epa.gov/no2-pollution/basic-information-about-no2.
"Cars." Transport for London. Accessed December 20, 2021. https://tfl.gov.uk/modes/driving/ultra- low-emission-zone/cars.
"Certificats Qualité de l'air : Crit'Air." Ministère de la Transition Écologique. Accessed December 20, 2021. https://www.ecologie.gouv.fr/certificats-qualite-lair-critair#e5.
"The Challenges with Electrochemical NO2 Sensors in Outdoor Air Monitoring." Aeroqual. Last modified July 23, 2018. Accessed August 13, 2021. https://www.aeroqual.com/challenges-electrochemical-no2-sensors-outdoor-air-monitoring.
Chen, Tze-Ming, Janaki Gokhale, Scott Shofer, and Ware G. Kuschner. "Outdoor Air Pollution: Nitrogen Dioxide, Sulfur Dioxide, and Carbon Monoxide Health Effects." Abstract. American Journal of the Medical Sciences 333, no. 4 (April 1, 2007). Accessed September 3, 2021. https://doi.org/10.1097/MAJ.0b013e31803b900f.
Chen, Zhanghua, Muhammad T. Salam, Sandrah P. Eckel, Carrie V. Breton, and Frank D. Gilliand. "Chronic Effects of Air Pollution on Respiratory Health in Southern California Children: Findings from the Southern California Children's Health Study." Journal of Thoracic Disease. Accessed September 5, 2021. https://doi.org/10.3978/j.issn.2072-1439.2014.12.20.

"Concentrations of Nitrogen Dioxide." UK Government. Accessed August 13, 2021. https://www.gov.uk/government/statistics/air-quality-statistics/ntrogen-dioxide.

"Crit'Air Clear Air Stickers - Need to Know for Driving in France." Royal Automobile Club. Last modified August 1, 2019. Accessed December 18, 2021. https://www.rac.co.uk/drive/news/motoring-news/law-change- for-uk-drivers-in-french-cities/.

"Crit'Air New Regulations in France." Alphabet. Accessed December 20, 2021. https://www.alphabet.com/files/crit%27air-management-briefing---almar-052.3.pdf.

Dawson, Stanley V., and Marc B. Schenker. "Health Effects of Inhalation of Ambient Concentrations of Nitrogen Dioxide." American Review of Respiratory Disease 120, no. 2. Accessed August 13, 2021. https://www.atsjournals.org/doi/abs/10.1164/arrd.1979.120.2.281.

Department for Environment, Food and Rural Affairs. "Nitrogen Dioxide in the United Kingdom." News release. 2004. Accessed July 29, 2021. https://uk-air.defra.gov.uk/library/assets/documents/reports/aqeg/nitrogen_dioxide_in_the_UK-summary.pdf.

"Diffusion Tubes." Love Clean Air South London. Accessed August 17, 2021. https://lovecleanair.org/about-air-quality/how-pollutants-measured/diffusion-tubes/#.YRvMftNufQ0.

E Instruments. n.d. "Health Effects of Nitrogen Dioxide (NO2) Levels in Homes." E Instruments. Accessed August 13, 2021. https://www.e-inst.com/applications/adverse-effects-of-elevated-no2/.

Ellis, David, and Harry Fletcher. "Parks in London: The Capital's Most Glorious Green Spaces, from Hyde Park to Clapham Common." Evening Standard. Last modified June 14, 2021. Accessed August 15, 2021. https://www.standard.co.uk/reveller/attractions/londons-best-parks-near-me-guide-outdoor-activities-greenery-a3512556.html.

"Euro 1 to Euro 6 Guide – Find out Your Vehicle's Emissions Standard." Royal Automobile Club. Accessed December 20, 2021. https://www.rac.co.uk/drive/advice/emissions/euro-emissions-standards/.

Faustini, Annunziata, Regula Rapp, and Francesco Forastiere. "Nitrogen Dioxide and Mortality: Review and Meta-analysis of Long-term Studies." European Respiratory Journal 44, no. 3 (February 20, 2014): 744-53. https://doi.org/10.1183/09031936.00114713.

"First Month of Mayor's ULEZ Sees 74 per cent of Vehicles Comply." Mayor of London. Last modified May 16, 2019. Accessed September 5, 2021. https://www.london.gov.uk/press-releases/mayoral/almost-three-quarters-complying-with-new-standards.

"How Cities Use Parks to Improve Public Health." City Parks Forum. Accessed August 20, 2021. https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/Parks-Improve-Public-Health.pdf.

"Ihre Umweltplakette für Frankreich (Certificat Qualité de L'Air) hier Beantragen" [Apply for your environmental sticker for France (Certificat qualité de l'Air) here]. Green Zones European Union. Accessed December 20, 2021 https://www.lez-france.fr/en.html.

Incecik, Selahattin, and Ula Im. "Air Pollution in Mega Cities: A Case Study of Istanbul." Air Pollution - Monitoring, Modelling and Health, March 23, 2012. Accessed December 19, 2021. https://doi.org/10.5772/32040.

"Latest Measured Levels Based on Data Provided by the Environment Agency." UK Air. August 13, 2021. https://uk-air.defra.gov.uk/latest/currentlevels?view=region.

"The Mayor's School Air Quality Audit Programme." Mayor of London. Accessed August 18, 2021. https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/mayors-school-air-quality-audit-programme.

"The Mayor's Ultra Low Emission Zone for London." Mayor of London. Accessed August 29, 2021. https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/mayors-ultra-low-emission-zone-london.

Mckercher, Grant R., Jennifer A. Salmond, and Jennifer K. Vanos. "Characteristics and Applications of Small, Portable Gaseous Air Pollution Monitors." Environmental Pollution 223 (April 2017): 102-10. Accessed September 20, 2021. https://doi.org/10.1016/j.envpol.2016.12.045.

"Nearly Every London School in High Air Pollution Area, Report Says." BBC News. Last modified August 16, 2021. Accessed August 17, 2021. https://www.bbc.co.uk/news/uk-england-london-58230278.

"Nitrogen Dioxide." American Lung Association. Accessed August 10, 2021. https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/nitrogen-dioxide.

"% of Public Green Space (Parks and Gardens)." World Cities Culture Forum. Accessed August 13, 2021. http://www.worldcitiesculturefforum.com/data/of-public-green-space-parks-and-gardens.

O'Hare, Ryan. "One in Four of London's Green Spaces Breaches Air Quality Safety Limits." Imperial College London. Last modified October 10, 2019. Accessed August 17, 2021. https://www.imperial.ac.uk/news/193331/one-four-londons-green-spaces-breaches/.

"Parks and Green Spaces." Mayor of London. Accessed August 30, 2021. https://www.london.gov.uk/what-we-do/environment/parks-green-spaces-and-biodiversity/parks-and-green-spaces.

"Passive Diffusion Tubes." Cheshire East Council. Accessed August 13, 2021. https://www.cheshireeast.gov.uk/business/environmental_health/local_air_quality/what_is_pollution_like_near_me/diffusion_tube_monitoring/diffusion_tube_monitoring.aspx.

Root, Tik. "Doctors Are Prescribing Park Visits to Boost Patient Health." National Geographic. Last modified June 29, 2017. Accessed December 20, 2021. https://www.nationalgeographic.com/science/article/parks-prescribes-doctors-health-environment.

"The Royal Parks' Traffic Reduction Measures to Remain in Place for Another Year." The Royal Parks. Last modified March 9, 2021. Accessed December 21, 2021. https://www.royalparks.org.uk/media-centre/press - releases/the-royal-parks-traffic-reduction-measures-to-remain-in-place-for-another-year.

Sheikh, Knvul. "How Much Nature Is Enough? 120 Minutes a Week, Doctors Say." The New York Times. Last modified June 13, 2019. Accessed September 7, 2021. https://www.nytimes.com/2019/06/13/health/ nature-outdoors-health.html.

Sheridan, Charlotte E., Charlotte J. Roscoe, John Gulliver, Laure De Preux, and Daniela Fecht. "Inequalities in Exposure to Nitrogen Dioxide in Parks and Playgrounds in Greater London." International Journal of Environmental Research and Public Health 16, no. 17 (September 1, 2019): 3194. Accessed August 3, 2021. https://doi.org/10.3390/ijerph16173194.

Shima, Masayuki, and Motoaki Adachi. "Effect of Outdoor and Indoor Nitrogen Dioxide on Respiratory Symptoms in Schoolchildren." International Journal of Epidemiology 29, no. 5 (October 2000): 862-70. Accessed August 5, 2021. https://doi.org/10.1093/ije/29.5.862.

Stevenson, Ken, Tony Bush, and Diane Mooney. "Five Years of Nitrogen Dioxide Measurement with Diffusion Tube Samplers at over 1000 Sites in the UK." ResearchGate. Last modified December 2001. Accessed August 20, 2021.
https://www.researchgate.net/publication/222130929_Five_years_of_nitrogen_dioxide_ measurement_with_diffusion_tube_samplers_at_over_1000_sites_in_the_UK.

"Technical Report on UK Supplementary Assessment under The Air Quality Directive (2008/50/EC), The Air Quality Framework Directive (96/62/EC) and Fourth Daughter Directive (2004/107/EC) for 2019." UK Air. Accessed December 21, 2021.
https://uk-air.defra.gov.uk/assets/documents/reports/cat09/2102111100_ 2019_PCM_technical_report.pdf.

Tiseo, Ian. "Monthly Concentration of Nitrogen Dioxide in Select European Cities 2019-2021." Statista. Last modified November 23, 2021. Accessed November 30, 2021. https://www.statista.com/statistics/1185973/no2-concentrations-in-select-cities-in-europe-covid-19/.

"Using Diffusion Tubes." Care4Air. Accessed August 13, 2021. https://www.care4air.org/air-pollutants/ using-diffusion-tubes/.

"Vans, Minibuses and More." Transport for London. Accessed December 20, 2021. https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/vans-minibuses-and-more.

"What Is a Multi Gas Detector?" International Gas Detectors. Last modified November 17, 2020. Accessed September 7, 2021. https://www.internationalgasdetectors.com/what-is-a-multi-gas-detector.

"Where You Need to Have a Crit'Air Sticker in France." The Connexion. Last modified June 27, 2019. Accessed December 19, 2021. https://www.connexionfrance.com/Practical/Transport/france-crit-air-car-stickers-what-they-are-why-you-need-them-and-how-to-get-one.

White, Mathew P., Ian Alcock, James Grellier, Benedict W. Wheeler, Terry Hartig, Sara L. Warber, Angie Bone, Michael H. Depledge, and Lora E. Fleming. "Spending at Least 120 minutes a Week in Nature Is Associated with Good Health and Wellbeing." Scientific Reports 9, no. 1 (June 13, 2019). Accessed August 20, 2021. https://doi.org/10.1038/s41598-019-44097-3.

World Health Organization. Air Quality Guidelines for Europe. WHO Regional Office for Europe, 2000. Accessed August 20, 2021. https://www.euro.who.int/__data/assets/pdf_file/0017/123083/AQG2ndEd_7_1nitrogen dioxide.pdf.

WHO Guidelines for Indoor Air Quality: Selected Pollutants. Copenhagen: WHO, 2010. Accessed September 1, 2021. https://www.ncbi.nlm.nih.gov/books/NBK138705/.

Yli-Pelkonen, Vesa, Anna A. Scott, Viljami Viippola, and Heikki Setälä. 2017. "Trees in Urban Parks and Forests Reduce O3, but not NO2 Concentrations in Baltimore, MD, USA." Science Direct. Accessed 18 August, 2021. https://www.sciencedirect.com/science/article/abs/pii/S135223101730523.

# EVALUATING THE SUSTAINABILITY OF HOUSING WITHIN INFORMAL TOWNSHIPS: A CASE STUDY OF MSHOLOZI INFORMAL TOWNSHIP LOCATED IN MBOMBELA – MPUMALANGA PROVINCE

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## INTRODUCTION

Housing seems to be the biggest challenge in South Africa, this is manifested in the rate at which informal settlements grow. In the African continent as of 2014 there is a total backlog of 50 562 000 houses and South Africa accounts for 2.3 million of this backlog, (El-hadj et.al, 2018). Scholars such as Noah (2017), are of the opinion that this housing challenge and need exist in South Africa because housing in the country is considered a basic human right. As a result, some South African citizens feel entitled to owning a free fully subsidized house. In most instances they take advantage of the law in an attempt to get the government's attention and quick delivery of housing by invading vacant land to build informal housing. As a result, informal settlements develop adding on to the housing backlog that is already high and making it hard for the government to eradicate it. In South Africa informal settlers are protected from evictions by means of law under the Prevention of illegal Eviction from and unlawful occupation (PIE) Act of 1998 and the Constitution of the Republic of South Africa 1996, (Kate, 2010).

Msholozi is an informal township located in the Mpumalanga Province under Ehlanzeni District Municipality. It falls within the jurisdiction of the City of Mbombela (CoM) Municipality, it covers an area of 4.11 km² and consists of a population of 4 525 people and 1 816 households, (Statistics South Africa, 2011). The township is accessed from the R40 road (see figure 1) and is well located in between White River town and Nelspruit/Mbombela (the capital city of the Mpumalanga Province). Msholozi was formed when people started invading open land (which was previously a farm) to build shacks in August 2009, some of the invaders were people who used to work in the farm and could not afford to buy their own stands, (Riet, 2020). In 2003, after a successful land reform restitution claim, the Department of Agriculture, Rural Development and Land Reform transferred 6 000 hectares of land worth R62 billion to Matsafeni Community Trust so that 1000 families could benefit, (Sizwesama, 2020). The claimed land included land parcels in Msholozi and Matsafeni (where Mbombela stadium is based). The land was reclaimed from one of Mpumalanga's biggest farming company, namely: HL Hall & Sons. Msholozi Township is divided into six sections, there is a Phumlani Village, Hopeville and Msholozi A, B, C, and D.


*Figure 4. Map of Msholozi by HDA ArcGIS*

## HOUSING IN MBOMBELA

The CoM Municipality consists of formal households (as a dominating dwelling type), informal households and some unspecified type dwelling type. In 2016 an increase of 12.4% was noted in formal households which when converted to numbers makes 186 769 from only 166 136 formal households in 2011, (City of Mbombela, 2017). This followed after the municipality and the MPDHS made efforts to formalize some informal settlements. There was also an increase in informal households as of 2016 of 17 154 from 13 792 informal households in 2011 (refer to figure 2 below). People in the area tend to accommodate themselves on any vacant piece of land, even on top of mountains.

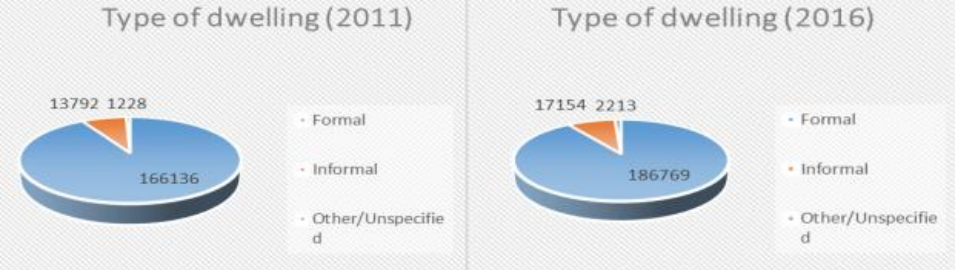


*Figure 2.Dwelling types in Mbombela by StatsSA (2011) and Community Survey (2016) cited in COM IDP (2017)*

According to (City of Mbombela, 2017) an estimated backlog of 32 554 units in the year 2017 was noted in the CoM. This backlog is said to be caused by rapid population growth as a result of migration, according to a CoM official. The migrants are largely from Nkomazi and Bushbuckridge local municipalities which are both neighbours of the CoM Municipality. Table 2 below shows the housing waiting list of the city per ward for 2017, which depicts the extent of the housing backlog. Msholozi falls under Ward 30 which includes White River, Phumlani Village and Rocky's Drift, the housing waiting list for Ward 30 in 2017 constituted of only 400 people.

| WARD 1 | WARD 2 | WARD 3 | WARD 4 | WARD 5 | WARD 6 | WARD 7 | WARD 8 | WARD 9 | WARD 10 | WARD 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| 550 | 1400 | 600 | 600 | 710 | 380 | 800 | 875 | 670 | 870 | 650 |
| **WARD 12** | **WARD 13** | **WARD 14** | **WARD 15** | **WARD 16** | **WARD 17** | **WARD 18** | **WARD 19** | **WARD 20** | **WARD 21** | **WARD 22** |
| 625 | 910 | 207 | 23 | 12 | 780 | 1705 | 1760 | 1900 | 780 | 1010 |
| **WARD 23** | **WARD 24** | **WARD 25** | **WARD 26** | **WARD 27** | **WARD 28** | **WARD 29** | **WARD 30** | **WARD 31** | **WARD 32** | **WARD 33** |
| 1150 | 1040 | 750 | 1350 | 1800 | 1080 | 765 | 400 | 400 | 575 | 2200 |
| **WARD 34** | **WARD 35** | **WARD 36** | **WARD 37** | **WARD 38** | **WARD 39** | **WARD 40** | **WARD 41** | **WARD 42** | **WARD 43** | **WARD 44** |
| 650 | 1100 | 650 | 475 | 310 | 710 | 745 | **2420** | **150** | **1680** | **1050** |
| **WARD 45** | | | | | | | | | | |
| **1380** | | | | | | | | | | |

*Figure 5. Housing waiting list per ward in Mbombela by COM IDP 2017*

## FACTORS INFLUENCING THE DEVELOPMENT OF INFORMAL TOWNSHIPS

Informal townships emerge as a result of frustrated citizens taking matters into their own hands to provide housing for themselves. With the case of Msholozi Township the residents did not just end by providing housing for themselves but saw an opportunity to provide for others and make an income out of it, revealed a CoM official. It was observed that there is a lot of dysfunctional low-cost housing prevalent in the township. Dysfunctional in the sense that landlords are more concerned with making profit and neglect their tenant's safety and living conditions as most of these accommodations are overcrowded. Some does not permit sunlight, some are built up to building lines which compromise tenants' privacy.

### Housing shortage

The residents of Msholozi claim to have bought the stands in which they have constructed their houses on. They revealed they opted to buy the stands illegally due to a lack of housing, as renting is expensive in towns (Nelspruit and White River). Residing in townships also requires a transport budget and means spending many hours commuting to and from work whereas Msholozi is strategically located between their areas of work.

### Housing right

The democratic government raised people's expectations when it broke down the news that people will have access to free, fully subsidized houses, in 1994 when it assumed power, as noted by Msholozi residents. (Noah, 2017), echoes the same sentiments and adds that this created a sense of entitlement and dependency. Msholozi residents revealed that they settled on this land because they were tired of waiting on the government to provide houses for them, as some have been waiting since as far back as 1996.

### Lack of transparency

There seems to be a lack of transparency in terms of the way the government operates. The public has no access to information that can come to their aid. It's clear with the case of Msholozi that the residents have means to provide for their own housing, they only needed to be provided with stands by the government. When they were asked about the different subsidies available for their utilization such as Finance Linked Individual Subsidy Programme (FLISP) (which caters for the gap market earning between R 3 500 and R15 000) they had no knowledge of them. Others revealed that if they were updated about the progress of housing delivery maybe they would have waited for their turn and not lose hope on the government to provide for them.

### Lack of/minimal public engagement

The rate at which informal settlements grow shows a lack of public engagement in decision making and where it exists it seems to be minimal. This can also be blamed to a lack of capacity in government offices. Government officials only do public engagements as a way of covering their scope of work and for compliance purposes, they are not really interested in what the people have to say, and are said to be always in a rush to finish tasks, stated Msholozi residents.

### Slow rate of service delivery

Service delivery in South African townships seems to be happening at a very slow pace, this is depicted by frustrated residents who take to the street to protest for the delivery of services. The rate at which public or private open land is invaded for the development of informal settlements also show a slow rate of the delivery of housing by the government. As mentioned earlier some residents revealed that they waited for so long for government to provide housing free fully subsided for them.

### Illegal sale of land

It was observed that the houses built in Msholozi ranges from double-storey mansions, aesthetically appealing 3-5 bedroom houses and low-cost rental rooms. Majority of the residents claim to have bought their stands. Hence, the construction of houses using permanent and costly material.

### Corruption

Corruption is a challenge faced by most countries around the world and it prevents progress and development, (Tatenda, 2016). Theft of property and state funds seems to be a norm in government due to hierarchies, lack of accountability to subordinates by high-level officials who engage in shady tender deals with private firms. The residents of Msholozi blames slow housing delivery to corrupt government officials who steal funds and also to nepotism where officials prioritize their relatives over the needy.

### Lack of affordability and access to financial loans

Due to high unemployment rates and low wage rates in South Africa the low income group (earning R0 – R3 500 per month) fail to provide shelter for themselves, and end up being reliant on the government for housing. As per Statistic South Africa's quarterly labour force survey, unemployment rate in the country rose to 34.4% in quarter 2 from 32.6% in the first quarter, adding half a million workers to the unemployed labour force which now makes a total of 7.8 million people, (Sara, 2021). Another common factor among informal dwellers is a lack of access to financial loans for housing development.

## CHALLENGES FACED IN INFORMAL TOWNSHIPS

Informal settlements or townships are bound to be faced with challenges as a result of developing on unauthorized land and without following appropriate town planning regulations.

### Fear of eviction

A key challenge faced by informal settlements/township dwellers is the fear of eviction as a result of settling on land they do not own. In August 2018 it was reported that 28 houses were demolished at Phumlani Village, among those houses was a mansion worth about R2 million leaving families homeless (SABC News, 2020).

### Poor service and infrastructure delivery

At the time of invasion Msholozi did not have infrastructure such as piped water, electricity, sanitation, and a clinic, only one small primary school existed, stated Msholozi residents. The lack of services resulted to residents making means to provide for their own services by means of illegal electricity connections and illegal dumping of waste at bus stops (see figure 4). However, the CoM now provides services in the area such as waste removal on Thursday mornings only and water through communal taps on certain days of the week, revealed the residents of Msholozi but illegal dumping still continues. Also, in 2020 the CoM started connecting electricity in the area. Some of the streets in the area consists of clay and during rainy days' cars have to reroute because it becomes dangerous to drive on the streets.

*Figure 6. Poor Service and Infrastructure by Authors*

### Transport

The residents of Msholozi have been suffering from a lack of reliable and efficient transport system. The situation is now better when compared to the early years of the establishment of the township, noted the residents of Msholozi. The residents solely rely on minibus taxis and Buscor public buses that travel on strict timetables, favoring minority of the residents.

### Problematic township layout

In some parts of the township, a problematic layout has been formed. Some of the evern have double road access, others are not accessible at all by car as they are located in proximity to a wetland (see figure 5 below), on flood lines and buffers. Also, some of the houses built are not in line with building regulations and standards, as some lack ventilation and take 100% coverage of an erf.

*Figure 5. Inaccessible houses and a house built on a wetland by authors*

### Health implications of the challenges faced in Msholozi

Housing plays a crucial role in determining the health of its occupants and substandard housing is a major public health issue. In Msholozi Informal Townships challenges such as overcrowding (in some social housing), the location of houses on wetlands, lack of ventilation, houses that do not permit sunlight and illegal dumping of waste have health implications. Overcrowded housing is associated

with activations and transmission of tuberculosis, respiratory infections, and psychological distress (James Krieger et.al, 2002). When there is no ventilation the interior moisture of houses increases, and this excessive indoor temperature can cause mental health issues such as irritability and social intolerance. Houses located on wetlands normally become damp which makes them a nurturing environment for mites and roaches which contributes to respiratory disease pathogeneses. This also places residents at risk as it exposes them to floods, making them vulnerable. The fact that some of the houses in the township do not permit sunlight makes them cold and living in cold houses is associated with lower general health status and increased used of health services. Children may also get infected with diseases such as TB from playing near open waste dumped on the streets, and sites of improper waste disposal causes land pollution, and can harbor pests which can then infest homes.

## ASSESSING MSHOLOZI TOWNSHIP AGAINST INTEGRATED AND SUSTAINABLE HUMAN SETTLEMENTS INDICATORS

The concept of measuring the sustainability of informal settlements in cities has not been well explored in developing countries, notes (Juanita, 2020). This concept rests upon three main pillars. Namely: social, economic and environmental pillar/dimension and the interaction of these pillars contributes to the development of healthy social environments. The table below indicates that Msholozi Township is sustainable.

| Dimension | Composite Indicators | Excellent/ High | Good/Moderate | Poor/Low |
|---|---|---|---|---|
| Economic Dimension | Employment | √ | | |
| | Income | | √ | |
| | Type of occupancy | | √ | |
| Environmental Dimension | Risk of natural disasters | √ | | |
| | Access to tap water and sanitation | | √ | |
| | Access to other public services | | √ | |
| | Air Quality | √ | | |
| | Vegetation | | | √ |
| | Pollution sources in the township | | | √ |
| Social Dimension | Education | | √ | |
| | Health | √ | | |
| | Safety | √ | | |
| | Sense of belonging | √ | | |
| Built-environment Dimension | Public facilities and spaces | | √ | |
| | Housing construction materials | | √ | |
| | Overcrowding | | √ | |
| | Land use | √ | | |
| | Accessibility and mobility | | √ | |
| **Total** | | **7** | **9** | **2** |

*Table 2. Measuring the sustainability of Msholozi by Montoya et.al 2020 and authors*

Integrated and Sustainable Human Settlements indicators are different from sustainable development indicators, they range from an integrated street network to various dwelling typologies and others. The table below shows that Msholozi Township is not an Integrated and Sustainable Human Settlement. However, it has a potential to become one.

| Indicators | Excellent | Good | Poor |
|---|---|---|---|
| Integrated street network | | | √ |
| A range of dwelling types and tenure options | | | √ |
| Social facilities | | √ | |
| Various transport modes | | √ | |
| Economic amenities | | √ | |
| Public spaces and sites | | | √ |
| Green Infrastructure | | | √ |
| Consideration in design for safety and security | | | √ |
| Urban greening and agriculture | | | √ |
| **Total** | **0** | **3** | **6** |

*Table 2. An assessment of Msholozi against indicators of integrated and sustainable human settlements by author*

### Integrated street network

There is an opportunity for the CoM municipality to provide an integrated street network in the area with lanes dedicated for cycling. This is necessary to promote Non-Motorized Transport considering that White River is 8.1 km away from Msholozi where majority work and do their shopping.

### A range of dwelling types and tenure options

Once the area has been formalized there is an opportunity for different housing typologies to be developed and for residents to have tenure options such as ownership or rental.

### Social facilities

Currently there is an existing primary school in the area. According to residents there is a secondary school that is being developed in the area and is almost completed. There is hope for other facilities to be developed once the area has been formalized, as it is stated by (City of Mbombela, 2018) that the area will be formalized and thereafter services and infrastructure will be provided.

### Transport modes

Two modes of public transport exist in the area: minibus taxis and Buscor bus service. Almost a quarter of the population in the area rely on private motor vehicles for transport. According to the City of Mbombela (2018) a bus terminal/taxi rank is proposed to be established at Heidelberg Road/Wilkens Road intersection just outside of Msholozi which will also be enroute to Phumlani Village.

### Economic amenities

There are small businesses in the township ranging from manufacturing and sale of bricks, sale of wood for fire and for building purposes, driving schools, Spaza shops and hair salons, butcheries, guest houses, private health clinics and a pharmacy.

## MOTIVATION FOR FORMALIZATION OF MSHOLOZI INFORMAL TOWNSHIP

The integration and densification of cities has become a need in South Africa, as it is necessary for the creation of livable and sustainable human settlements. Since 1994 the objective of the government has been to redress the country's spatial structure so as to achieve spatial justice, (National Planning Commission, 2020). Therefore, urban sprawl should be avoided at all costs, infill development and compactness of cities should be promoted instead. Msholozi Township promotes compactness: unlike most informal settlements or housing, it is well located between two towns. It also falls along the Nelspruit – White River Development Corridor as it is located closer to the R40.

### Priority Human Settlements and Housing Development Areas (PHSHDAs)

Msholozi forms part of PHSHDAs. According to a CoM official PHSHDAs are zones earmarked for the development of human settlements and for investment by both the private sector and government. These zones are meant to advance the consolidation and spatial transformation of human settlements by ensuring that housing delivery revitalize and restructure cities and towns while fostering integrated urban forms, in order to overcome the spatial patterns of apartheid, (Housing Development Agency, 2020).

### CoM Spatial Development Framework (SDF)

Msholozi forms part of an area earmarked for future residential development within the CoM SDF, it is also located closer to Rocky Drift (a regional node) which is along the R40 road, and falls within the municipality's urban edge, (City of Mbombela, 2018). Rocky Drift takes third position in terms of employment areas. In first position there is Nelspruit followed by White River.

### National Development Plan (NDP) 2040

Msholozi Township is aligned to the vision of the NDP of creating settlements that are sustainable, liveable and that support economic opportunities, (National Planning Commision, 2011). It also promotes the concept of living, playing and working in the same space as it is strategically located between job opportunities.

## CONCLUSION

In conclusion, it has been articulated that South Africa suffers from housing shortage and that it currently has a housing backlog of 2.3 million housing units. As a result of the high backlog and other factors such as unemployment and lack of financial resources, informal settlements/townships develop as the only affordable accommodation to the low-income group. Residents of these informal townships are faced with a number of challenges such as those faced in Msholozi Township which includes fear of eviction, poor services and infrastructure delivery etc. The sustainability of the township in question (Msholozi) was measured using indicators of sustainability and proved to be sustainable but when assessed against the characteristics of integrated and sustainable human settlements it scored poorly. However, there is a possibility for the township to become an integrated and sustainable human settlement as it falls within the boundary of PHSHDAs. As a result, it was motivated that the township should be formalized, and missing services and infrastructure be provided.

## NOTES

[1] El-hadj M. Bah, Issa Faye and Zekebweliwai F.Geh "Housing Market Dynamics in Africa" (Macmillan Publishers Ltd), 2018. 6-7.
[2] Noah K. Marutlulle, "Causes of Informal Settlements in Ekurhuleni Metropolitan Municipality: An Exploration," Africa's Public Service Delivery and Performance Review 5(2017):2-8.
[3] Kate Tissington, "A Resource Guide to Housing in South Africa 1994 – 2010" (SERI, 2011) 16.
[4] "Census" Statistics South Africa, accessed May 30, 2019. http://www.statssa.gov.za/?page_id=4286&id=11702
[5] Riet Hlatshwayo, "Premier Slams Land Invaders," Sowetan Live, June 14, 2020. https://www.sowetanlive.co.za/news/2009-08-17-premier-slams-land-invaders/
[6] Sizwesama Yende "Land Reform Gone Wrong: A Black Day Near White River," City Press, June 14, 2020. https://www.news24.com/citypress/News/land-reform-gone-wrong-a-black-day-near-white-river-20180806
[7] "City of Mbombela Final Integrated Development Plan (IDP) 2017 – 2022" City of Mbombela Municipality, accessed September 20, 2020. https://www.mbombela.gov.za/final%20idp%20for%202017-2022.pdf 102, 164-165.
[8] City of Mbombela, *IDP*, 102
[9] Noah, *Causes of Informal Settlements*, 2-8
[10] Tatenda Manomano, Pius Tangwe Tanga and Perpetuu Tanyi, "Housing Problems and Programs in South Africa: A Literature Review." Journal of Sociology and Social Anthropology 7(2016): 113.
[11] Sara Smith, "Unemployment Rate Hits Record High Again," Mail & Guardian, November 19, 2021. https://mg.co.za/business/2021-08-24-unemployment-rate-hits-record-high-again/
[12] "Houses Demolished, Leaving Msholozi residents Homeless" SABC News, June 09, 2020. https://www.youtube.com/watch?v=5VVOtI5iM0E
[13] James Krieger, MD, MPH and Donna L. Higgins, "Housing and Health: Time Again for Public Health Action". Public Health Matters. 92(2002): 758.
[14] Juanita Montoya, Ivan Carters and Antonio Zumelzu, "Indicators for Evaluating Sustainability in Bogota's Informal Settlements: Definition and Validation." Sustainable Cities and Societies 53(2020):3-4
[15] "City of Mbombela Spatial Development Framework (SDF) Review 2018 Working Document" City of Mbombela Municipality, accessed September 20, 2020. www.mbombela.gov.za/draft%20sdf%20document.pdf 79,168
[16] City of Mbombela, *SDF*, 2018.
[17] ´National Development Plan 2030: Our Future – Make it Work "National Planning Commission, accessed December 02, 2020, www.gov.za/documents/national-development-plan-2030-our-future-make-it-work 259.
[18] "The Housing Act: Declaration of the Priority Human Settlements and Housing Development Areas (PHSHDAs)" Department of Human Settlements, accessed August 08, 2020. https://www.gov.za/sites/default/files/gcis_document/202005/43316gon526.pdf 18.
[19] City of Mbombela, *SDF*, 2018.
[20] National Planning Commission, *National Development Plan*, 2011.

## BIBLIOGRAPHY

Ackerman, Christo. "Evaluating Integrated Human Settlements by means of Sustainability Indicators". Potchefstroom Campus: North-West University, 2016.
Charlton, Sarah. "State Ambitions and Peoples' Practices: An Exploration of RDP housing in Johannesburg. University of Sheffield, 2013.
Lehohla, Pali. "The State of Basic Service Delivery in South Africa: In-depth Analysis of the Community Survey 2016 Data". Statistics South Africa, 2016.
McGarry, Michelle, S. "From Housing to Human Settlements: The Role of Public Space in Integrated Housing Developments". Cape Town: University, 2017.
Mlangeni Thobile "Msholozi to be a Township". Mpumalanga News, June 14, 2020. https://mpumalanganews.co.za/178710/msholozi-township/
Obioha, Emeka, E. "Addressing Homelessness through Public Works Programmes in South Africa". South Africa: Walter Sisulu University, 2019.
Rai, Pallasi, T. "Townships for Sustainable Cities" Procedia Social and Behavioral Sciences 37(2012):417-426.

Rerat Patrick. “Housing, Compact City and Sustainable Development: Some Insights from Recent Urban Trends in Switzerland” Switzerland: University of Neuchatel.

Tagg Jason, H, “Providing Adequate Housing in South Africa in the Twentieth and Twenty First Century,” Pretoria: University of Pretoria, 2012.

Turok, Ivan. “The Three Pillars of Sustainable Human Settlements”. Cape Town: Human Sciences Research Council, 2011.

# CIVIC TECHNOLOGY: A CATALYZER TO ENHANCE COMMUNITY PARTICIPATION IN PLANNING

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## INTRODUCTION

Adequate community engagement in city planning constitutes a significant factor for generating community-oriented solutions. In the U.S., many marginalized cities with low engagement during planning are experiencing a declining quality of life through the built environment. The foundational theories of community engagement and the emerging of field "Civic Technology" were applied to examine the role and impact of community participation in developing a master plan in a metropolitan suburb located just east of Washington D.C. The city of Seat Pleasant was self-designated in 2016 as the first "Smart City of Excellence" of Maryland.[1] It is undergoing a planning effort that focuses on economic revitalization and growth along the east-west corridor connecting Seat Pleasant to Washington D.C. and to suburban communities branching off the I-95 interstate, a major artery of the east coast. The purpose of this study was to evaluate whether a more dynamically engaging planning process applied to a convenience sampling of the city's population yields similar or different development results as those identified in the undergoing master plan. High-level community engagement was conducted at public meetings and field visits. Through an automated survey system, a measurement instrument collected qualitative and quantitative data on preferences for development, views on shared heritage and social inclusion, and desires for retaining the community's culture. The key findings of this study indicated that the community of Seat Pleasant favored a different location of development along the northwest corridor, where there are important civic landmarks bellied with signs of physical, social, and economic decay. The community engagement process incentivized dialogue on developing a master plan that reflects a community-oriented vision, identifying potential enhancements that can foster the revival of a community's vitality and improve quality of life through health, wellbeing, and place. This study's methodological approach can serve as a tool for enhancing community engagement practices in the planning process of cities under redevelopment.

### The Decline of Community Participation

The primary means a planner seeks to ascertain the community's views are through a process of consultation. The planner aggregates the community's views and coopts this knowledge into the techno-rational planning system.[2] The credibility and effectiveness of planners on the ground diminish when the deliverables fail to conceptualize the community's specific needs and, in many cases, privilege other non-community-related interests. The skepticism that the community builds on the legitimacy of planning processes results on many occasions with non-participation, and the lack of

community engagement is adversarial to those most affected by the system.[3] As a result, the traditional urban planning approaches are criticized for ignoring and downplaying the importance of public engagement, equity, and transparency.[4]

The decline of community participation in planning has direct consequences on the built environment. Many cities are experiencing a decline in publicly owned civic spaces and increased privatized public spaces. Historically, public spaces served a democratic purpose as well as a social one. Public spaces act as an infrastructure of social life and create a communal identity.[5] Consequently, the impact of low community engagement allows the private sector to focus on developing public spaces with commercialization goals rather than promoting civic life. That solitary goal results in generic gentrification-oriented development solutions, placing the community at risk of displacement and threatening the cultural and civic essence of a city.

## LITERATURE REVIEW

This study is guided by the idea that traditional urban planning requires a "transformative" approach that is not only addressed theoretically but from a practical perspective. The exploration of more recent literature proposes the field of "Civic Technology" as a catalyzer to increase community participation in planning. Civic technology, in this thesis, is understood as a platform that enables community participation through data collection and feedback sharing.[6] The exploration of civic technology literature fostered innovative thinking about planning problems of effectiveness and social democratization. Additionally, this research also focused on understanding the foundational theories of community engagement that have been part of academia over the last forty years. These various theories are analyzed in-depth to better understand the different obstacles communities and planners have in overcoming issues of legitimacy and competence.

### Civic Technology

Urban planners are still grappling with technologies' role in community engagement and in formal planning processes. Traditionally, urban planners focus on the use of technology for post-planning infrastructural solutions, whereas Civic Technology is better understood as an innovative and effective mechanism for democratizing the planning process of a city. As a field, Civic Technology leverages data to address challenges invisible to or neglected by the government in a collaborative, problem-centered way.[7] The Five Core principles that can serve as best practices are: (1) focus on people, (2) understand and leverage existing institutions and social networks, (3) respond to the needs articulated to the community, (4) let those needs and desired outcomes drive the technical aspects of the work, and (5) demonstrate meaningful community engagement and participation.[8]

These core Civic Technology principles can become tangible strategies during the planning stage in multiple ways. For instance, to enhance community participation, virtual forums are platforms that shift the scale from a neighborhood to an individual. This intentional downsizing increases the opportunity to connect and engage residents in problem identification. The use of "civic tech" platforms empowers community members to enter dialogue with different perspectives, and by doing this, the personal inputs are grouped to identify the communal challenges. In a 2011 study, Hernandez et.al analyzed two civic tech sites developed by mySociety and found that a significant proportion of the community participants were first-time users of neighborhood forums engaging in civic issues of the city and might not otherwise have engaged in communal planning activities.[9] Another potential implementation of civic technology is when individuals or small groups are open to being monitored. The generated data can lead to "community wellbeing interventions." For example, in a civic app created by Web Map Services (WMS), community participants volunteered to be geographically tracked. The obtained data created well-crafted visualizations of the streetscape allowing the

allocation of performance indicators allowing the city to prioritize infrastructural solutions.[10] This phenomenon of humans acting as sensors or data providers is sometimes perceived as intrusive and adversarial; however, creating voluntary and specific technologies to the community stimulates the gathering of relevant neighborhood-level information and becomes a modern way for residents to engage civically.[11]

## Levels of Community Engagement

Community participation has a long history in academic research dating back as far as the 1960s. One of the best papers starting the discussion on this topic is by Sherry Arnstein in 1969, it categorizes the involvement of communities in a 'ladder of citizen participation. At the bottom of the ladder, non-participation and at the top is the ideal model of citizen control.[12] The criticism of this basic categorizing model is that citizen control may not be appropriate in every circumstance.[13] Another approach differentiating the degrees of legitimacy communities are given during the planning process is provided by Hannah Pitkin in 1967, which is highly criticized for diminishing the importance of the "represented".[14] More recently, there has been a call for communities to identify a representative who only is legitimate if the group they seeking to represent accepts. Co-production methods of planning are also being incentivized. Here all stakeholders set the conditions of participation and a certain degree of the expected outcomes.[15] One of the challenges in this approach is that the legitimized elected officials and the community representatives may lack the knowledge and competence, requiring in certain cases to absorb a certain amount of expert knowledge before they are competent to be part of a formal planning process.[16]. The above described theories are graphically summarized in Figure 1.

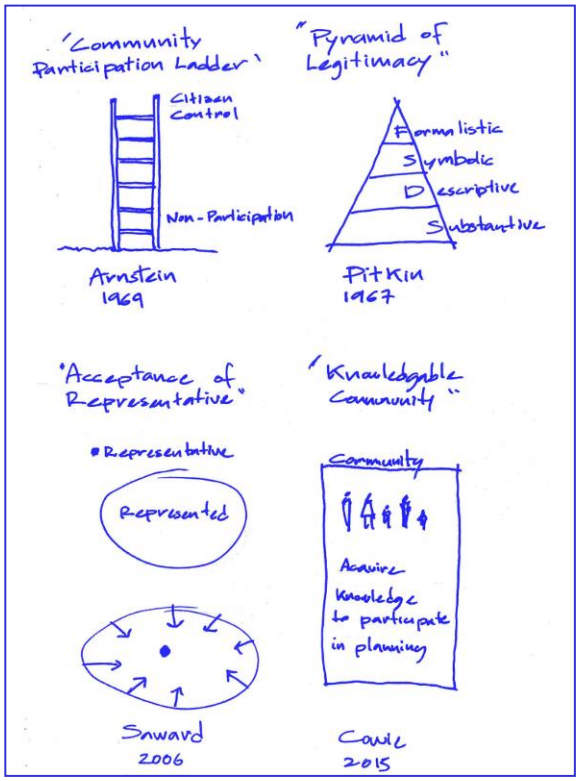


*Figure 1. Foundational Theories of Community Participation in Planning.*

### Importance of Community Participation in Planning

It is challenging for urban planning as a discipline to alone establish goals and arrive to a community vision. Much of the decision-making is not in the hands of the urban planners but involves numerous stakeholders from policymakers, private funders, city officials, and community representatives.[17] The importance of including a process of community participation is principled in building partnerships among all the stakeholders. This may include public presentations, focused grouped discussions, workshops used to inform, share perspectives, and gather feedback between the community and those leading urban development projects. In this context, the planner's role is to enable a formal partnership process and a community-facilitated design process intended to invigorate community engagement. Establishing a community engagement groundwork produces beneficial outcomes by building on existing community strengths, increasing civic engagement, and strengthening community relationships.[18]

## CASE STUDY

### The City of Seat Pleasant

As the Washington D.C. region grows in population and national prominence, multiple surrounding communities are preparing for growth, as is the case of the City of Seat Pleasant located just east of Washington, D.C. Home to approximately 5,000 residents, the city shares many of the same challenges as those facing many of the 27 cities in Prince George's County. This small city owes its emergence in the late 1800s to the Chesapeake Beach Railway and became home to Maryland's first railway station. The city quickly evolved from a subdivision of small plantation farms to a predominantly African American town around 1940. 70% of the homes existing today were built between 1940 to 1960, reaching a population peak of close to 7,000. In the 1960s, the easier accessibility to the automobile in the United States resulted in the discontinuation of commuting railway services in Seat Pleasant. Since then, residents perceive a community in decline, and presently, the city is struggling to grow. The lack of a cohesive vision has augmented the poverty levels and vacancy. The noticeable infrastructural disinvestment is affecting Seat Pleasant and the adjacent communities with financial consequences and, most importantly, lower quality of life for its residents.

Seat Pleasant has been part of many past planning efforts, predominantly planning exercises across multiple jurisdictions. For instance, in the late 1970s, Prince George's County invested in an auto-oriented infrastructure, hoping to attract government agencies to the city and other nearby neighborhoods. Due to the unappealing commercial and residential fabric of that time, government agencies declined any participation. In the late 1980s, a similar master plan allowed the blue metro line to reach the boundaries of Seat Pleasant. These two planning exercises gave the City of Seat Pleasant excellent metro connectivity to Washington D.C. However, the lack of local employment and predominantly suburban and auto-oriented grid belies these assets. However, the lack of a good street infrastructure for easy access to the metro stations and concerning issues in safety is the result of today's low levels of ridership.

One of the most recent planning efforts from the city started in 2016. Under the leadership of Mayor Eugene W. Grant, Seat Pleasant was self-designated as the first "Smart City of Excellence" in Maryland. This initiative sought to elevate the city from its last 50 years of slow growth by becoming a pioneer in smart technological investments. While the plan supports existing efforts created by Prince George's County, the plan itself is the first-ever specifically for the City of Seat Pleasant. In 2018 city officials signaled a commitment by hiring the recognized master planning firm SOM (Skidmore, Ownings & Merril) to elaborate a vision of economic revitalization and population growth. This proposal agglomerates blocks of mixed-use multi-family buildings along the city's main

artery, Martin Luther King Jr. Highway. Furthermore, the city officials, reflecting on the idea that a "Smart City" must be felt through a physical experience, have integrated technology solutions provided by numerous private sector entities of the "Smart City" marketplace.

A review of the planning process and the master plan showed that SOM's planning initiative contained a limited community participation process. The assumption made in this study is that SOM had contractual limits to carry on more substantive community engagement practices. Furthermore, the fact that Seat Pleasant's officials sought resources outside of the city due to revenue problems rearranged the community's priorities. Because of this, the mix-methodological approach in this study consciously aimed to foster opportunities for the selected community participants of Seat Pleasant to elaborate on their civic engagement roles and the desired city amenities. The carried surveys and interviews enabled the identification of the infrastructure problems at the city scale and evaluated how future developments should alter the civic identity of the community. The findings of this study are relevant since they highlight the missed opportunities in creating civic life in Seat Pleasant's master plan. The methodological approach of this research is suitable to be replicated in the nearby communities of the Washington DC region facing similar challenges.

## METHODOLOGY

The research methodology in this study intersects with the theoretical framework in Civic Technology, proposing the researcher gives the community participants means of legitimacy and enables processes for input and decision making. Thus, the incorporated mixed methodology of this study integrates both qualitative and quantitative research characteristics. The tools implemented in this study followed two categories. First, the knowledge and planning tools focused on mapping the city's physical characteristics. Secondly, the civic engagement tools focused on the shared heritage and desires of retaining a cultural and civic identity. Thus, the data in this research reflects the community's sense of belonging and identity and the spatial and physical characteristics of Seat Pleasant.

Identifying the research priority in the case of Seat Pleasant had challenges considering the existence of the official 2018 master plan. The city requested SOM develop a master plan of economic revitalization and growth. Nevertheless, the city did not anticipate the need for more substantial community engagement or inclusion in the contracted services. Because of this, the primary purpose of this study was to evaluate whether a more dynamically engaging planning process applied to a convenience community sampling yields similar or different development results as those proposed in the official master plan. High-level engagement with the community was conducted at public meetings and in-field visits. This study obtained community views on overall development and solicited views about community identity and civic engagement. The surveys included stratification questions regarding race, education levels, income, and age to validate the sampling size, which moderately reflected the general population data gathered from the 2020 US Census – comparison illustrated in Figure 2.

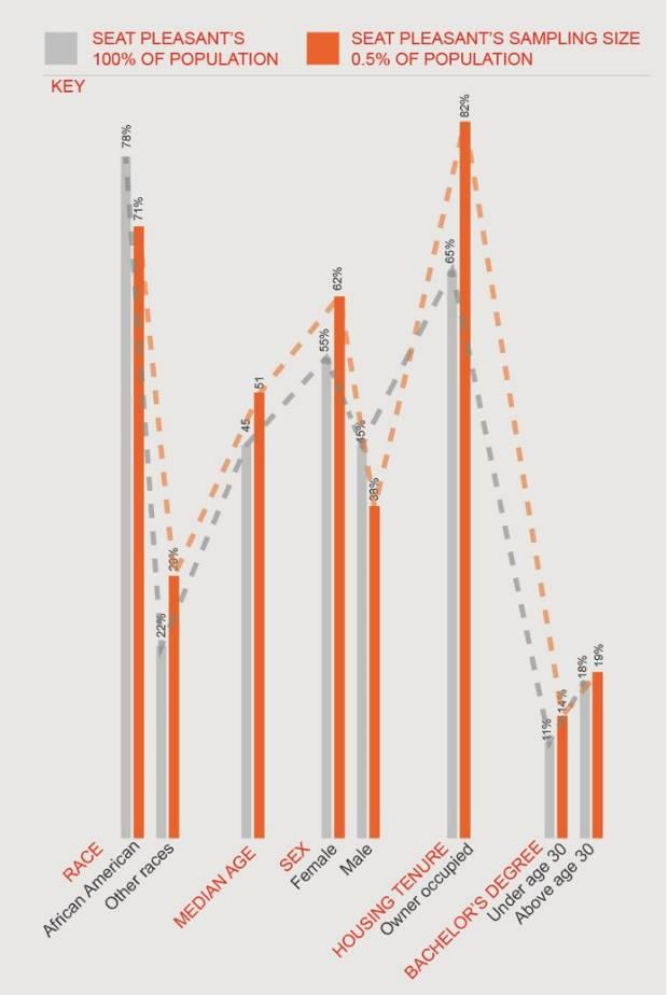


*Figure 2. Comparison of Seat Pleasant Overall vs. Sampling Population.*

Throughout all four rounds of surveying sessions, out of the 83 solicitations to participate in this study, a total of (N=27) participants completed the surveys. The proportion of participants who participated in the virtual platforms is twice as large compared to the field surveys, with a total of 18 submissions completed virtually and 9 in the field. In addition, it is relevant to note that the attendees of the virtual City Council meetings provided a higher response rate. 4.2 out of every 10 participants completed the survey in comparison to 2.2 out of every 10 participants completing surveys in the field – as illustrated in Table 1.

| DATE | SURVEY MODE | LOCATION | SURVEY ATTEMPTS | RESPONSES RECEIVED | RESPONSE RATE |
|---|---|---|---|---|---|
| June 14 | Virtual QR Code | ▪City Council Public meeting via zoom | 27 (links opened) | 11 | 41% |
| June 27 | In-person | ▪Mt Victory Baptist Church<br>▪Grace Cathedral<br>▪Congressional Methodist Church | 20 (hard copies) | 5 | 25% |
| July 12 | Virtual QR Code | ▪City Council Public meeting via zoom | 16 (links opened) | 7 | 43% |
| August 14 | In-person | ▪Intersection Addison & MLK Highway<br>▪Shopping Center Central Ave & Addison Road | 20 (hard copies) | 4 | 20% |
| | | | TOTAL | 27 | 32.25% |

*Table 1. Surveys Distribution Timeline.*

## FINDINGS

The key findings of this study indicated that the community of Seat Pleasant favored a different development located along the northwest corridor, where there are signs of physical, social, and economic decay in the built environment and important historic landmarks to the community. The participants of this study (N=27), when asked what type of community they envision in the next 20 years, identified Seat Pleasant as to primarily remain as a "family-friendly" community; nevertheless, a significant finding is that the community encourages Seat Pleasant to become a "destination community." While the official 2018 master plan focuses on economic revitalization and growth along the east-west corridor, Martin Luther King Jr. Hwy, the interviewed participants favor development along the northwest corridor, along Addison rd. where there are essential civic and historic landmarks for the community-as illustrated in Figure 4.

The measuring instrument had a strong focus on obtaining health and well being indicators since Seat Pleasant performs very low in health measures relative to other communities of the Washington D.C. area with higher rates of diabetes, adult obesity and alcoholism. The qualitative findings allowed the community to pinpoint that the unappealing pedestrian infrastructure provided no access to the few recreational and sport amenities of the community. The relevance of these qualitative findings is that these create criteria for supporting a master plan focues on the direct issues for the community to improve Health and Well-being indicators.

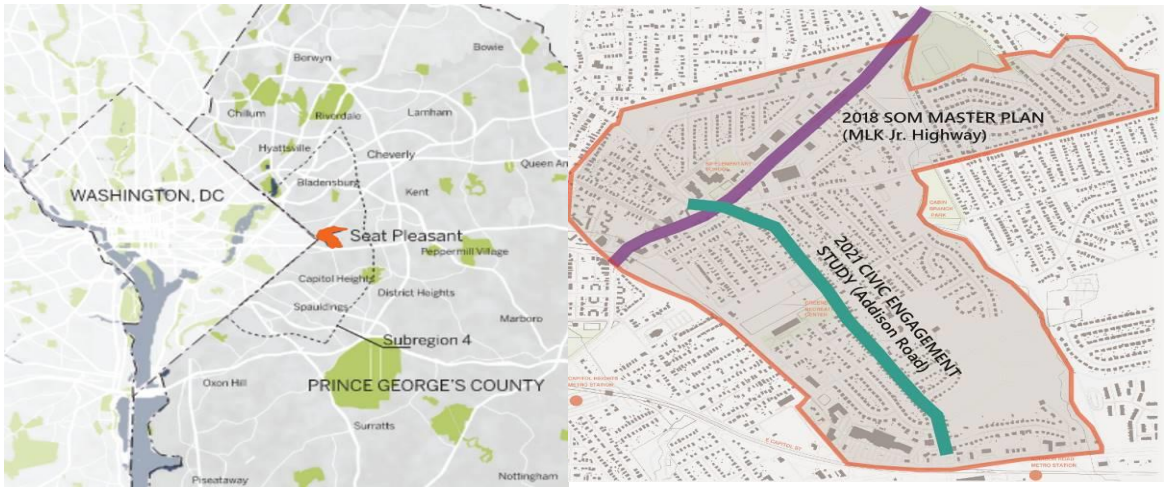


*Figure 3. Seat Pleasant Map & Community's Development Preference*

## Suggestion

This study concludes that the community prefers any future development along Addison Road due to its meaningful civic fabric and finding that the community desires to become a "destination" city. The suggestion of this study is to reinforce the historical civic core along Addison Road to retain the community character. However, to increase the attractiveness of Seat Pleasant, the neighboring communities must also become attractive; therefore, any proposals must align with the county-wide effort to make the neighboring communities safer and incentivize investment. The existing commercial amenities of these neighborhoods miss opportunities to bring income from travelers passing by the beltway and those commuting across these neighborhoods to Washington D.C. The 2018 SOM Master Plan for Seat Pleasant provides connectivity opportunities and establishes in MLK Jr. long-term attractions for various economic activities; however, it primarily focuses on turning drivers into shoppers but lacks an experiential approach. Thus, the proposed plan amends the 2018 SOM Master Plan with a core focusing on a civic embellishment of the city of Seat Pleasant – as represented in Figure 5.


*Figure 5. Seat Pleasants Community Oriented Master Plan Proposal. Hand Sketches by Torti Gallas.*

## CONCLUSION

Creating a framework that helps build or repair trust between citizens and public agencies. A critical task for planners moving forward is to explicitly connect with communities as members or leaders, survey how technology can facilitate civic engagement, and support fact-finding and community-focused planning solutions. Civic Technology helped assess the community's issues and create criteria to propose master planning solutions of importance to the community in this study. Civic technology becomes a tool to create an evidence-based planning approach, guiding urban planners to navigate the ethical and practical challenges and helping urban planners become more credible to communities.

## NOTES

[1] "Seat Pleasant's Master Plan," City of Seat Pleasant, accessed September 19,2020, https://www.seatpleasantmd.gov/255/City-Master-Plan
[2] Graham Pycock, "Extended Viewpoint London Governance and the Politics of Neighbourhood Planning: a Case for Investigation," Town planning review 91, no. 1 (2020): 37.
[3] Paul Cowie, "Performing Planning: Understanding Community Participation in Planning through Theatre," Town planning review 88, no. 4 (2017): 411.
[4] David Watson, Managing Civic and Community Engagement (Maidenhead: Open University Press, 2007), 45.
[5] David Watson, Managing Civic and Community Engagement, 51-52.
[6] Wendy Sarkissian et.al, "Creative Community Planning : Transformative Engagement Methods for Working at the Edge," Studies in Media and Communications, no.14 (2017), doi: 10.1108/s2050-206020170000014012.
[7] Vanessa Watson, "Co-production and collaboration in planning: the difference," Planning Theory & Practice, no. 15, (2014):65, doi: 10.1080/14649357.2013.866266.
[8] Vanessa Watson, "Co-production and collaboration in planning: the difference," 74.
[9] Gasco Hernandez et. al. ""Citizen Co-production Through Open Data: Cases of Citizen Training and Engagement" (paper presented at the 18th Annual International Conference on Digital Government Research, New York, NY, September 12-15, 2017).
[10] Gaby Sarah, "Media Use and Participant Inclusion: Influences on Efficacy in Paid Staff Youth Nonprofit Civic Organizations, in "Social Movements and Media," Studies in Media and Communications, no.14 (2017), doi: 10.1108/s2050-206020170000014012.
[11] Wendy Sarkissian et.al, "Creative Community Planning : Transformative Engagement Methods for Working at the Edge."
[12] Sherry Arnstein, "A Ladder of Citizen Participation."Journal of the American Institute of Planners 35(1969): 219
[13] Zaana Howard et.al. "A comparative study of two design Charrettes: Implications for codesign and participatory action research," CoDesign, no. 10(1) (2014): 46–62. doi.org/10.1080/15710882.2014.881883
[14] Hanna Pitkin, The Concept of Representation (Berkeley: University of California Press, 1967) 32-34.
[15] Michael Saward, "The Representative Claim," Contemporary Political Theory 5 (2006): 301.
[16] Michael Saward, "Less Than Meets the Eye: Democratic Legitimacy and Deliberative Theory" (Abingdon:Routledge, 2000),66-77.
[17] Quintin Bradley, "The Political Identities of Neighborhood Planning in England." Space and Polity 19 (2015): 104.
[18] Gavin Parker et.al. "Planning at the Neighbourhood Scale: Localism, Dialogic Politics, and the Modulation of Community Action," Environment & Planning C: Government and Policy, no. 33 (2015):802. doi:10.1068/c1363.

## BIBLIOGRAPHY

Arnstein, Sherry. "A Ladder of Citizen Participation." Journal of the American Institute of Planners 35 (1969): 216–224.

Bradley, Quintin. "The Political Identities of Neighborhood Planning in England." Space and Polity 19 (2015): 97–109.

City of Seat Pleasant. "Seat Pleasant's Master Plan." Accessed September 19,2020. https://www.seatpleasantmd.gov/255/City-Master-Plan

Cowie, Paul. "Performing Planning: Understanding Community Participation in Planning through Theatre." Town planning review 88, no. 4(2020): 1-.

Hernandez Gasco, M. Martin, E.G., Reggi L., Pyo S. and Luna Reyes. "Citizen Co-production Through Open Data: Cases of Citizen Training and Engagement." Paper presented at the 18th Annual International Conference on Digital Government Research, New York, NY, September 12-15, 2017.

Howard, Zaana and Somerville, Mary. "A comparative study of two design Charrettes: Implications for codesign and participatory action research". CoDesign, no. 10(1) (2014): 46–62. doi.org/10.1080/15710882.2014.881883

Maryland Department of Planning. "Prince George's County Master Plans". Accessed January 14,2021. https://planning.maryland.gov/Pages/OurWork/compplans/viewplans.aspx

O'Reilly, Tim. "Government as a Platform." Innovations: Technology, Governance, Globalization 6(2011): 13-40.

doi:10.1162/INOVa00056.
Parker, Gavin and Street Emma. “Planning at the Neighbourhood Scale: Localism, Dialogic Politics, and the Modulation of Community Action.” Environment & Planning C: Government and Policy, no. 33 (2015):794-810. doi:10.1068/c1363.
Pitkin, Hanna. The Concept of Representation. Berkeley: University of California Press, 1967.
Prince George’s County Planning Department. “Approved Subregion 4 Master Plan and Sectional Map Amendment.” Accessed January 17, 2021 https://www.mncppcapps.org/planning/publications/BookDetail.cfm?item_id=257&Category_id=1
Pycock, Graham. “Extended Viewpoint London Governance and the Politics of Neighbourhood Planning: a Case for Investigation.” Town planning review 91, no. 1(2020): 1-.
Sarah, Gaby. “Media Use and Participant Inclusion: Influences on Efficacy in Paid Staff Youth Nonprofit Civic Organizations, in “Social Movements and Media.” Studies in Media and Communications, no.14 (2017): 209-240. doi: 10.1108/s2050-206020170000014012
Sarkissian Wendy, Hurford Diana, and Wenman Christine. “Creative Community Planning : Transformative Engagement Methods for Working at the Edge.” London ;: Earthscan, 2010. Studies in Media and Communications, no.14 (2017): 165-168. doi: 10.1108/s2050-206020170000014012
Saward, Michael. “Less Than Meets the Eye: Democratic Legitimacy and Deliberative Theory”. Abingdon:Routledge, 2000.
Saward, Michael. “The Representative Claim”. Contemporary Political Theory 5 (2006): 297–318.
Watson, David. Managing Civic and Community Engagement. Maidenhead: Open University Press, 2007.
Watson, Vanessa. “Co-production and collaboration in planning: the difference.” Planning Theory & Practice, no. 15, (2014):62–76. doi: 10.1080/14649357.2013.866266.

# CONNECTING PEOPLE TO NATURE IN CITIES: TOWARDS AN INCLUSIVE AND SUSTAINABLE URBAN ENVIRONMENT

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## INTRODUCTION

Cities must change, a transition towards a more sustainable urban environment should be promoted and appropriate solutions that enable cities to better meet the needs of citizens could be implemented in an environment of interdisciplinary collaboration, in which all people involved in the design of cities can participate in the decision making.[1] To restore the ecological balance of the city and move towards a more sustainable environment, it is possible to promote new modes of collaborative design that result in more environmentally sustainable projects. The paper will show proposals that can inspire and enhance innovation to connect people to nature in cities to move towards an inclusive and sustainable city for all. Environmental sustainability is a premise in all the proposals, that include the design of urban elements made with sustainable and recyclable materials, seeking to extend their life cycle; the use of permeable pavements to design safe routes for all people, the inclusion of green urban furniture that improve air quality and the use of strategies that limit CO2 emissions and favour a responsible use of resources. The aim is to reflect on the current guidelines of urban design promoting innovation in cities to progressively change them in favour of healthier, safer, and more sustainable urban environments.

### Nature Based Solutions

Nature-based Solutions (NbS) are defined as actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.[2] The term Nature-based Solutions goes beyond traditional principles of biodiversity conservation and management, focusing on human beings and specifically integrating social factors such as human well-being and poverty reduction, socio-economic development and governance principles. With NbS, healthy, resilient and diverse ecosystems (whether natural, managed or newly created) can provide solutions for the benefit of societies and biodiversity in general[3].

NbS are based on eight fundamental principles: adoption of the rules and principles of nature conservation; implementation (autonomously or integrated with other solutions) to societal challenges, such as technological solutions; inclusion of traditional, local and scientific knowledge; contribution of social benefits in a fair and equitable way that promotes a broad participation of society; maintenance of biological and cultural diversity; landscape-scale application; balance

between obtaining a few immediate economic benefits for development and future options for the production of the full range of ecosystem services and finally, integration into policies and actions aimed at addressing a specific societal challenge.[4] Based on these principles, quality NbS actions would be those that rely on ecosystems, present benefits for the preservation of biodiversity and contribute directly to a specific social challenge.

In the field of architecture and urban planning, the scope of application of NbS is broad and beneficial for society in general, especially in a context such as that of our country, a Mediterranean country. To combat the heat and in general, for reasons of physical and psychological health, it is essential to expand green areas and spaces in cities, such as corridors, green roofs and walls, islands of vegetation, community gardens, etc. Green walkways, on the other hand, allow citizens to move between different areas of the city with a lower average temperature, thanks to greater shade and vegetation.[5] In short, it is possible to promote healthy mobility and the proliferation of wildlife. Regarding the last aspect, abandoned urban areas represent unrivaled opportunities to reintroduce indigenous biodiversity. On the other hand, the management of urban ecosystems must be similar to any natural ecosystem, also integrating human activities in them harmoniously.[6] For this, in our cities, of all the types of renewable energies that exist, the one with the greatest potential is solar energy, given the incredible climatic conditions and solar radiation in our region. It could be possible to reach a scenario with photovoltaic solar panels in buildings (public and private), with the consequent reduction of CO2 emissions and maximization of savings in electricity bills. Other relevant energies include biomass, wind and geothermal, as well as, to a lesser extent, natural biological reactions.[7]

In addition, NbS constitute positive actions for a wide range of agents involved, since they not only generate benefits at an environmental and economic level, but also socially. In fact, NbS are part of the daily lives of people living in cities, and as such, their involvement in their design and implementation is critical. For this reason, although the occasions in which the implementation of NbS entails public participation are not common nowadays, there seems to be a growing interest on the part of planners and managers in incorporating the perceptions and values of the community about the new urban green spaces.[8] In this sense, for NbS to be actions that address social challenges effectively and adaptively, society must be an active part of them. Citizen participation can be used in various aspects, such as, for example, conducting an analysis of what is the citizen perception of the provision of ecosystem services offered by specific NbS projects,[9] their participation in the design of new proposals using co-design and even collaborating in the implementation of the proposals.[10]

## OBJECTIVES AND METHODOLOGY

The objective of this paper is to promote Solutions based on Nature (NbS) in the urban environment, to contribute ideas and actions on how to achieve better urban environments, taking advantage of the benefits that society and biodiversity can bring with the implementation of the NbS. For this, some intervention proposals in urban areas will be shown that aim to promote the idea of healthy and sustainable cities, considering the principles of NbS for public spaces, community gardens, social and cultural activities, leisure, etc. The methodology that has been used in the design of the proposals has been based on the co-design with the end user, so as to ensure citizen participation in the generation of the proposals and in their implementation, seeking to connect society with nature through these proposals. For this, the design has been done in the framework of an architectural innovation workshop where solutions were provided to be contrasted by both the architects and the citizens through debates that happened regularly to foster participation, where architects raise topics of interest to define the NbS proposals and to develop reasoning capabilities.

In order to engage end users, the workshop creates an environment that fosters productivity and talent using collaborative, scalable techniques that, though individually developed, are applied to the global

training of the group. One of the expected outcomes is an increasing flow of ideas and proposals. In fact, architecture tackles innovation from an integral and multidisciplinary approach, acknowledging science, technology, and design models as valid creative sources. So urban and architectural proposals keep a technological foundation and, at the same time, are based in nature, providing a proposal of value for society. Besides, design thinking was used to develop innovative proposals, and the following milestones where followed: detecting problems that needs to be solved in the urban environment; defining the user profile the innovative project is oriented towards, based in inclusive design; approaching the functionality and the key features of the proposal, as well as the competitive edges; preparing technical definition documents; approaching through the Design for Manufacture and Assembly methodology; and finally, using prototypes for validation.

## FINDINGS

The proposals designed through these methodologies are presented below, organized according to the milestones stated in the previous section. Thus, in the first place, it is worth mentioning the interest in generating proposals that consider nature-based solution that, at the same time, count on the participation of all sectors of society, in order to promote design for all. It is about including in the design of urban spaces people with special needs, as well as people with reduced mobility, which includes people with a permanent disability, elderly people or people who have temporary problems caused by illness or accidents. In our country, these sectors of the population account for about 40% of the total. Besides, the need to include all sectors of the population in our cities has been reflected within the goals of the SDG Agenda 2030 for sustainable development, more specifically in Goal 11: Make cities and human settlements safe, resilient, and sustainable.

### Challenges to face

In the first place, therefore, it is necessary to analyze the problem in existing urban environments and then try to propose answers that can solve these situations, as far as possible. After analyzing various urban areas of the city, the following challenges to face are raised. A first evident problem in urban areas found is the scarce separation between road traffic and pedestrian traffic that occurs in some areas and that particularly affects at times of high concentration of road traffic at peak hours, in which pedestrians must avoid cars due a lack of enough pedestrian space. Another aspect to highlight is the recreational space. Large areas are required that could be in areas that are currently underused and where urban furniture protected against inclement weather, as well as green areas should be located.

In addition, a certain lack of control between pedestrians and drivers in the parking zone is also common in the areas analyzed due to the fact that both itineraries intertwine. Also, the lack of covered routes to cope with inclement weather; the lack of clear signs or information points that help to move safely in the urban area; the shortage of ramps or elements that help people with a disability, that prevent anyone with limitations of any kind from moving independently within the area and finally, the need for more (and better planned and located) rest areas or outdoor social areas that could be located in unoccupied areas with great potential. The existence of permeable pavements that help to a greater integration of the urban environment with nature is also lacking.

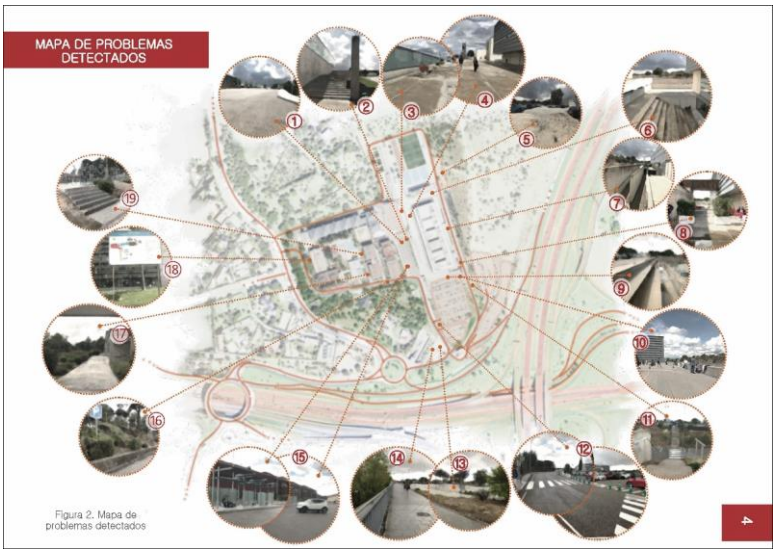


*Figure 1. Site plan for the analysis of challenges to be solved in urban environments by Mar Hernández, Cristina Villarés and Alejandra Vernet.*

## Co-design with the end user

To include end users on nature-based designs we have carried out several methodologies. On the one hand, empathy maps have been made with end users, that also included people with different abilities. In addition, questionnaires have been carried out to analyze in depth the urban spaces on which to intervene from the point of view of the citizens. With all the information collected, a series of data visualizations were created that helped define a series of needs.

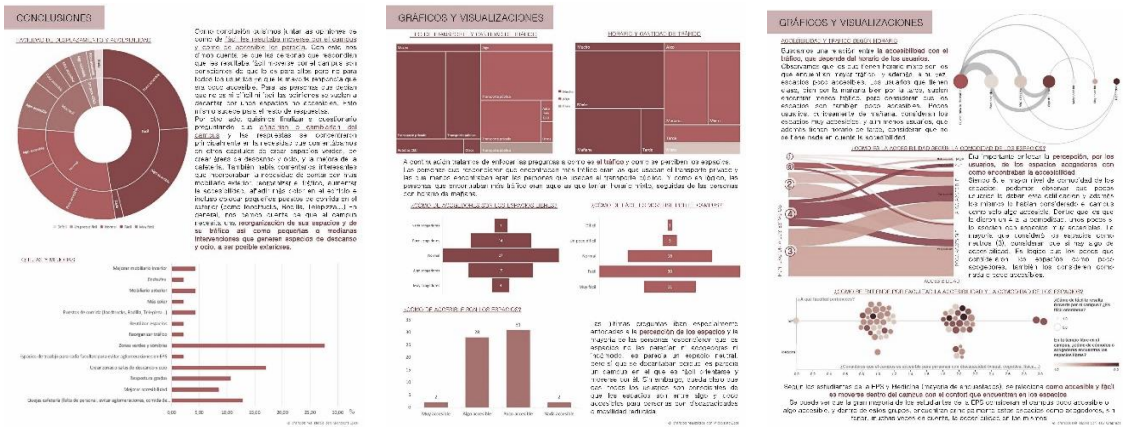


*Figure 2. Data visualizations created using data extracted from the forms and empathy maps made by Mar Hernández, Cristina Villarés and Alejandra Vernet.*

From the visualizations, a series of relevant conclusions can be drawn regarding mobility and accessibility issues in the urban areas analyzed, which come to determine that it is not easy to move around the urban space for all users. Regarding the opinions collected on which would be the improvements that they would implement as users, the answers were mainly concentrated on the need to create green spaces, rest and leisure areas, and the improvement of services. Interesting comments were also collected about the need to have more outdoor furniture, reorganize traffic, increase accessibility, add more color to the urban space and even place small spaces enabled for recreation and leisure protected from the rain.

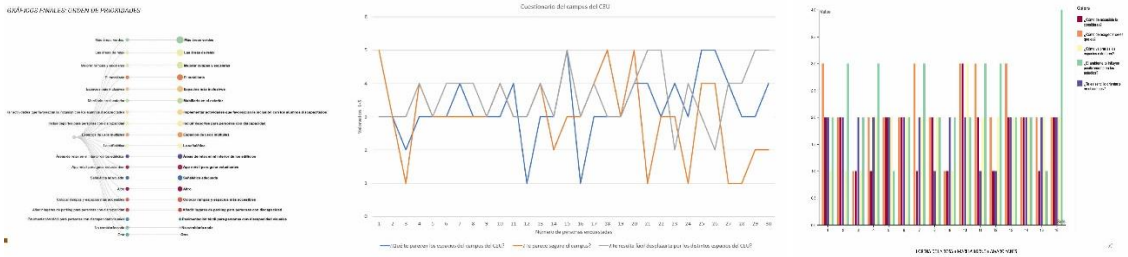

*Figure 3. Data visualizations created usign data extracted from the forms and empathy maps made by Sara Pulvirentti, Sonia Méndez, Manuel Fustamante, Tais Guevara, Judith Chuquicallata, Lorena de la Rosa, Marina Lorne and Álvaro Yanes.*

The clearest demands that are extracted from the analysis of the visualizations are related to the presence of urban spaces more integrated with nature. In urban areas, the inclusion of some vegetation is detected exclusively as a decorative element. It is considered that vegetation, large green areas, and the creation of links with nature should be a constant in urban spaces to generate shade on hot days in the summer seasons or shelters from the rain. A greater coexistence between urban spaces and nature is called for in order to make the spaces more livable and pleasant. The improvement of outdoor spaces and the need for vegetation and green spaces has been a constant claim.

## Nature based proposals

The presented proposals are based on the NbS approach, standing out for their innovative capacity, their suitability for the user's profile, their quality in terms of design and their environmental sustainability. By being designed in collaboration with the end users, which also included people with special abilities, they ensure the fulfillment of the objectives of sustainable development. With them, a better interaction of the different types of users with urban services is ensured. New ways of offering the necessary information on urban services are proposed, the incorporation of comfortable and accessible urban furniture for all citizens or the use of more easily readable signage elements for people with some type of visual or hearing disability. New permeable pavements are also proposed that allow greater integration with the natural environment and the inclusion of vegetation and green areas in recreational spaces.

All projects have undergone a life cycle analysis that allows the idea of an open life cycle to be promoted from their design, so that the projects are recyclable and reusable, using materials with a very long useful life with little maintenance. Some have focused on proposing routes with a permeable pavement to improve integration with nature, where they also use a modular, light, adaptable roof that allows users to be covered from the sun or rain along the routes. In them, they propose modules of cantilevered pieces that serve as a covering element that are grouped to form covered walks that can be grouped according to variations using translucent, opaque materials and with different colors so that the high contrast facilitates differentiation for people with visual disabilities. Other modules incorporate integrated vegetation to improve the environmental sustainability of these areas.

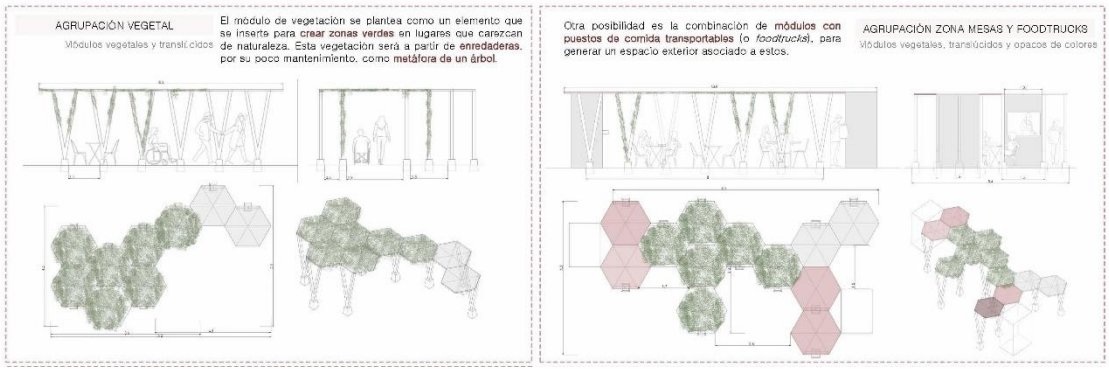


*Figure 4. Proposal for urban facilities based on nature by Mar Hernández, Cristina Villarés and Alejandra Vernet co-designed with end users.*

In other cases, ecological urban furniture systems are proposed in which urban gardens and orchards are integrated in different parts of the neighborhood to generate shared leisure spaces, in which natural elements are integrated. They are manufactured with recyclable materials, such as wood, and are easily configurable by end users according to their needs.


*Figure 5. Proposal for urban facilities based on nature by Manuel Fustamante, Tais Guevara and Judith Chuquicallata co-designed with end users.*

All the proposals involve citizen participation in their implementation. Some of them are committed to simple and accessible designs, so that residents of the neighborhoods participate in the assembly, adapting the services to their specific needs. Others, on the other hand, have turned the projects into interactive spaces with the user, allowing them to modify the urban elements according to their needs. In all cases, modular assembly systems have been chosen, with easily recyclable and reusable elements to adapt them to different needs depending on the time of year or user demand.

*Figure 6. Proposal for urban facilities based on nature by Lorena de la Rosa, Marina Lorne and Álvaro Yanes co-designed with end users.*

## CONCLUSION

The premise of the proposals has been the design of spaces that benefits for the preservation of biodiversity and contribute directly to the inclusion of all people. In all the proposals, the NbS approach has been taken into account with actions such as the analysis of the life cycle of materials or the use of strategies that limit CO2 emissions and favor a responsible use of the resources used. They also promote the use of permeable pavements to design safe routes for all people and the inclusion of green urban furniture that improve air quality. The aim of this paper was to reflect on the current guidelines of urban design promoting innovation in cities to progressively change them in favour of healthier, safer, and more sustainable urban environments.

## NOTES

[1] Dudley, Nigel; Stolton, Sue; Belokurov, Alexander; Krueger, Linda; Lopoukhine, Nik; MacKinnon, Kathy; Sandwith, Trevor and Sekhran, Nik. *Natural solutions: protected areas helping people cope with climate change*. Gland: World Wide Fund for Nature. 2010

[2]Cohen-Shacham, Emmanuelle; Walters, Gretchen; Janzen, Christopher and Maginnis, Stewart. *Nature-based solutions to address global societal challenges*. Gland, Switzerland: IUCN. XIII. 2016. https://portals.iucn.org/library/node/46191

Cowan Caroline; Epple, Cordula; Korn, Horst; Schliep, Rainer and Stadler, Jutta. (Eds.) *Working with nature to tackle climate change*. Bonn: Bundesamt für Naturschutz. 2010.

[3] Brears, Robert. *Nature-Based Solutions to 21st Century Challenges*. Routledge. 2020.

[4]IUCN. *Resolution 069 World Conservation Congress*. 2016. Hawai'i https://portals.iucn.org/congress/motion/077

[5] Dhyani, Shalini; Gupta, Anil Kumar and Karki, Madhav. *Nature-based Solutions for Resilient Ecosystems and Societies.* Springer. 2020

[6] Cowan Caroline; Epple, Cordula; Korn, Horst; Schliep, Rainer and Stadler, Jutta. (Eds.) *Working with nature to tackle climate change*. Bonn: Bundesamt für Naturschutz. 2010

[7] Torrego, Alicia. Soluciones basadas en la Naturaleza. Grupo de trabajo GT 10. *Congreso Internacional del medio ambiente*, Fundación COVAMA. 2018.

[8] Kremmer, Peleg; Hamstead, Zoe, Haase, Dagmar; McPhearson, Timon; Frantzeskaki, Niki; Andersson, Erik; Kabisch, Nadja; Larondelle, Neele; Rall, Emily; Voigt, Annette; Baró, Francesc; Bertram, Cristine; Gómez-Baggethun, Erik; Hansen, Rieke; Kaczorowska, Anna; Kain, Jaan Henrik; Kronenberg, Jakub; Langemeyer, Johannes; Pauleit, Stephan; Rehdanz, Katrin; Schewenius, Maria; Van Ham, Chantal; Wurster, Daniel and Elmqvist, Thomas. "Key insights for the future of urban ecosystem services research", Ecology and Society, vol. 21(2) (2016):29.

[9] Caballero-Serrano, Verónica; Alday, Josu; Amigo, Javier; Caballero, David; Carrasco, Juan Carlos; McLaren, Brian and Onaindia, Miren. 2017. "Social Perceptions of Biodiversity and Ecosystem Services in the Ecuadorian Amazon". Human Ecology 45 (2017): 475-486.

[10] Lorenzo, Covadonga. "Innovación arquitectónica y accesibilidad: entornos colaborativos para el fomento de soluciones arquitectónicas orientadas a lograr espacios públicos accesibles". Innovación Docente e Investigación en Ciencias, Ingeniería y Arquitectura: Nuevos Enfoques en la Metodología Docente. Dykinson. 2021.

## BIBLIOGRAPHY


Brears, Robert. *Nature-Based Solutions to 21st Century Challenges*. Routledge. 2020.

Caballero-Serrano, Verónica; Alday, Josu; Amigo, Javier; Caballero, David; Carrasco, Juan Carlos; McLaren, Brian and Onaindia, Miren. 2017. "Social Perceptions of Biodiversity and Ecosystem Services in the Ecuadorian Amazon". Human Ecology 45 (2017): 475-486.

Cohen-Shacham, Emmanuelle; Walters, Gretchen; Janzen, Christopher and Maginnis, Stewart. *Nature-based solutions to address global societal challenges*. Gland, Switzerland: IUCN. XIII. 2016. https://portals.iucn.org/library/node/46191

Cowan Caroline; Epple, Cordula; Korn, Horst; Schliep, Rainer and Stadler, Jutta. (Eds.) *Working with nature to tackle climate change*. Bonn: Bundesamt für Naturschutz. 2010.

Dhyani, Shalini; Gupta, Anil Kumar and Karki, Madhav. *Nature-based Solutions for Resilient Ecosystems and Societies.* Springer. 2020.

Dudley, Nigel; Stolton, Sue; Belokurov, Alexander; Krueger, Linda; Lopoukhine, Nik; MacKinnon, Kathy; Sandwith, Trevor and Sekhran, Nik. *Natural solutions: protected areas helping people cope with climate change*. Gland: World Wide Fund for Nature. 2010.

IUCN. *Resolution 069 World Conservation Congress*. 2016. Hawai'i https://portals.iucn.org/congress/motion/077

Kremmer, Peleg; Hamstead, Zoe, Haase, Dagmar; McPhearson, Timon; Frantzeskaki, Niki; Andersson, Erik; Kabisch, Nadja; Larondelle, Neele; Rall, Emily; Voigt, Annette; Baró, Francesc; Bertram, Cristine; Gómez-Baggethun, Erik; Hansen, Rieke; Kaczorowska, Anna; Kain, Jaan Henrik; Kronenberg, Jakub; Langemeyer, Johannes; Pauleit, Stephan; Rehdanz, Katrin; Schewenius, Maria; Van Ham, Chantal; Wurster, Daniel and

Elmqvist, Thomas. “Key insights for the future of urban ecosystem services research”, Ecology and Society, vol. 21(2) (2016):29.

Lorenzo, Covadonga “Innovación arquitectónica y accesibilidad: entornos colaborativos para el fomento de soluciones arquitectónicas orientadas a lograr espacios públicos accesibles”. Innovación Docente e Investigación en Ciencias, Ingeniería y Arquitectura: Nuevos Enfoques en la Metodología Docente. Dykinson. 2021.

MacKinnon, Kathy; Sobrevila Claudia and Hickey, Valerie. *Biodiversity, climate change and adaptation: nature-based solutions from the Word Bank portfolio*. Washington D.C.: World Bank. 2008.

Torrego, Alicia. Soluciones basadas en la Naturaleza. Grupo de trabajo GT 10. *Congreso Internacional del medio ambiente*, Fundación COVAMA. 2018

# THE CULTURAL IMPACTS OF DEVELOPMENT IN DC'S INNER-CITY COMMUNITIES

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## INTRODUCTION

Development in cities tends to focus on the economic and ecological benefits, while culture is often ignored in the design decision process. It is easy for society to understand economic and ecological benefits because they are quantifiable, which means that the value of these benefits can be calculated and given a numerical value. It is hard for society to understand the value of culture because its value cannot be quantified with a numerical number, only assessed through its significance held by individuals and communities. Incorporating culture into development decisions is important to social sustainability, especially in inner cities that are vulnerable to gentrification. This study examines three completed projects - a community center, a museum, and a demonstration center - in the District of Columbia's Ward 8 inner-city communities where culture was taken into consideration and highlights the benefits of these decisions. This research defines culture as the body of knowledge that is passed down through the generations and comprises all the traditions, habits, customs, beliefs, and capabilities that are acquired by the people by virtue of being a member of the society.

### Community Led Solutions and Considerations

This research aims to create a list of suggestions and considerations that can aid developers in considering culture in their decisions. When proposing a new development project within a community, a tool such as a checklist could help developers be more mindful of the community that they are serving. Any form of development of environmental design affects the immediate community and therefore that communities' needs should come before anything else. Recently we have seen several protest and demonstrations revolving around gentrification. The preservation of culturally significant structures within communities, prioritization of the communities needs over profit, and community-based design should all be norms within environmental design and development.

## THE ARGUMENT FOR COMMUNITY BASED DESIGN

The idea that a lack of cultural consideration in development leads to gentrification is not a new concept. Even in the modern day, there are still debates about gentrification, a facilities importance to a community, and even the erasure of a community's cultural identity. This is especially true for underserved communities, where important institutions that serve the community such as schools, places of worship, historic sites, etc. are often in situations where they could be demolished or replaced.[1] The argument surrounding gentrification is also an argument bout cultural sustainability.

The discussion around cultural sustainability stems from the demand for both 'ethical scholarship and activism' and the need to take culture seriously in an environment that is everchanging.[2] Another key component of the argument against gentrification is social sustainability. Social sustainability in the built environment essentially means that any development decision made within a community should not negatively affect future generations of that community.[3] Both cultural sustainability and social sustainability are major component in community-based design. Designers have a substantial impact on communities, community-based design ensures that all design decisions are not just made with the intention of benefiting a community but also ensuring that a community's cultural identity is not lost.

## Current State of Community Based Design

Architects have made strides in combating gentrification through design. Community-based research, urban development, walkable cities, and even adaptive reuse have all become major points of discussion with the environmental design community. Historic preservation is one of the major practices that architects utilize to ensure that a communities cultural identity remains intact through the built environment, it has a lot of social and cultural aspects.[4] It goes without saying that minorities should be involved in planning process within their communities.[5] Community-based design includes the community being served and makes sure it is their opinions and needs that drive the design. There have been proposals to improve upon these methods, for example making historic preservation more sustainable.[6] However despite all the strides that have been made, gentrification continues to be a problem in many communities.

## DC'S WARD 8

Ward 8 is located towards the southeastern end of Washington DC. It is home to historic Anacostia which is one of DCs oldest suburbs. Much of Ward 8 was once farmland, and a lot of its rural characteristics are still prevalent. Ward 8 is an interesting area to study given its rural history. There is a rich cultural and historic context, as well as number of different building typologies. This community is an area that has retained its rural roots in the urban city of Washington, DC. This area also is an underserved community vulnerable to gentrification. A panel of national experts identified the three projects where culture was considered in development decisions.

## History

Ward 8 is home to 2 historical districts, the Saint Elizabeth Hospital Historic District and the Anacostia Historic District as shown in Figure 1 below. Most of wards 8's historic places and sites are centered around these 2 districts. The Anacostia Historic District is one DC's first suburbs, originally majority white, until Frederick Douglass purchases a house here is 1877. The Saint Elizabeth Hospital Historic District was DC's first government mental health hospital and also served as a hospital during the civil war.

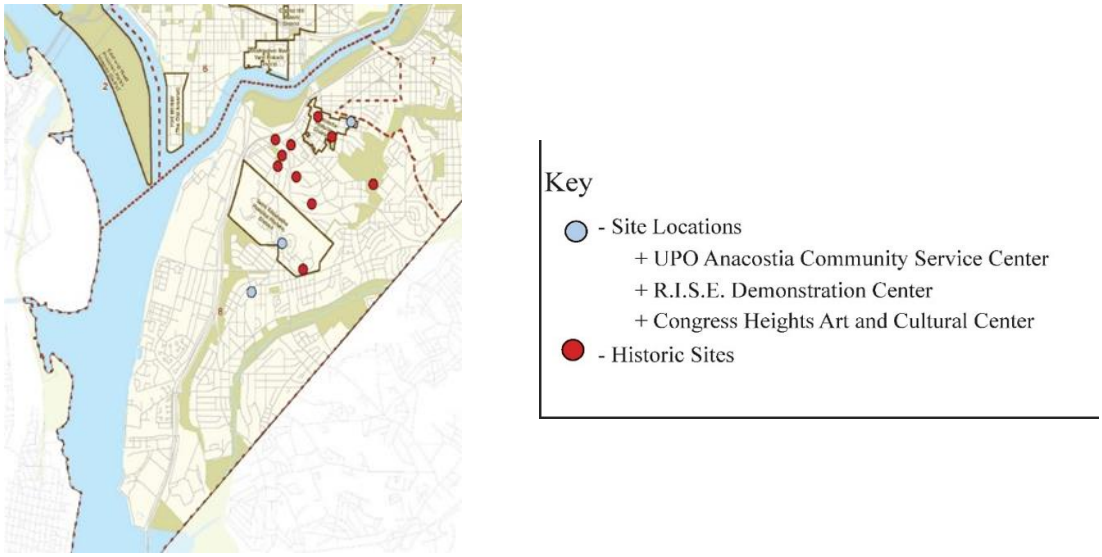


*Figure 1. Map of DC's Ward 8, showing case study locations and historic site locations*
*Source: DC Office of planning*

## Amenities

Ward 8's services are not necessarily abundant, and a lot the emergency services and stores are spread out and clustered as show in Figure 2 below. There are handful of public parks throughout, most notably Anacostia Park. There are only about 2 big grocery stores in ward 8, but there are several convenience stores scattered throughout. The service tends to be more clustered towards the northern part of the site, the southern part of the site seems to have less accessibility.

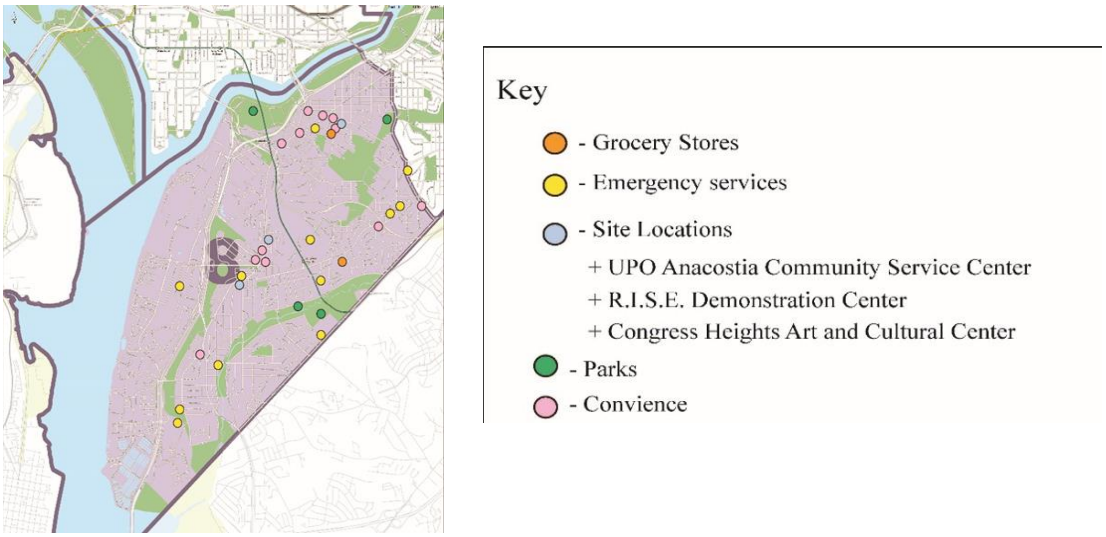


*Figure 2. Map of DC's ward 8, showing case study locations and amenities*
*Source: DC Office of Planning*

## Transportation

DC's ward 8 like many other parts of DC has accessible public transit. However, Ward 8's public transit is very minimal in comparison to the rest of the city. The online metro rail line that runs through ward 8 is the green line. In ward 8 itself there are only two metro rail stops, Anacostia and Congress heights. The main roads that run through ward 8 are I-295 and Suitland parkway. In addition

to metro rail stops, there are also several capital bike share locations and bus stops. See Figure 3 below.

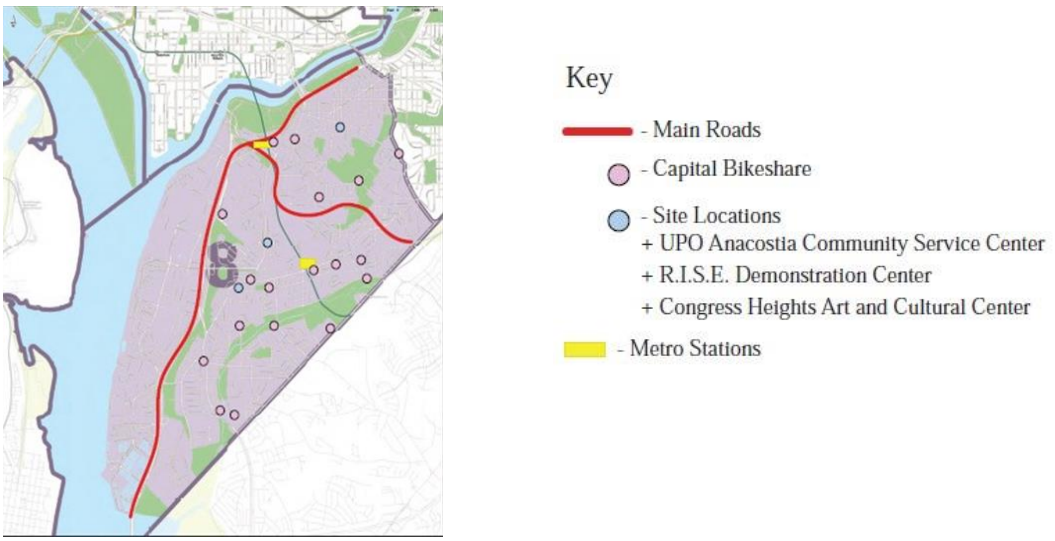


*Figure 3. Map of DC's Ward 8, showing case study locations and major transportation*
*Source: DC Office of planning*

**Current Development Versus Community Need**

Ward 8 is an area of Washington, D.C. that has a rich culture and history. However, the area is somewhat underserved. There are a number of amenities throughout ward 8, but they are clustered and not spread out, this creates areas such as food deserts where grocery stores are not within close proximity. a lot of the services are with proximity to public transit. However, the Metrorail line which is the main public transport used throughout D.C. only has two stops within the entire ward. There is a very strong divide between the military base and the rest of ward 8. much of Ward 8 is majority black with exception of the military base. The military base even though it is majority white, may be the most diverse part of the ward simply because it serves as a place of employment for so many servicemen. The base serves as an example of an area that has all of the services that the immediate population needs. There are plenty of historic sites within ward 8 especially within the historic districts of Anacostia and The Saint Elizabeth's Campus. There has been some attempt at creating more opportunity within the ward. There are a number of development projects that are occurring along MLK and near the Saint Elizabeth's Campus. There have also been economic development zones that have been established in order to assist businesses within the area. There is a lot of disparities in terms of the residents having access to what they need. Attempts are being made to improve the area. However, a lot of the development is focusing on education and housing, which in and of itself is not a problem but there needs a focus on services, especially food and transportation. This does not mean that the single-family aspect of the development should stop, but that there should be a focus on making sure these families have everything that they need. See Figure 4 below.

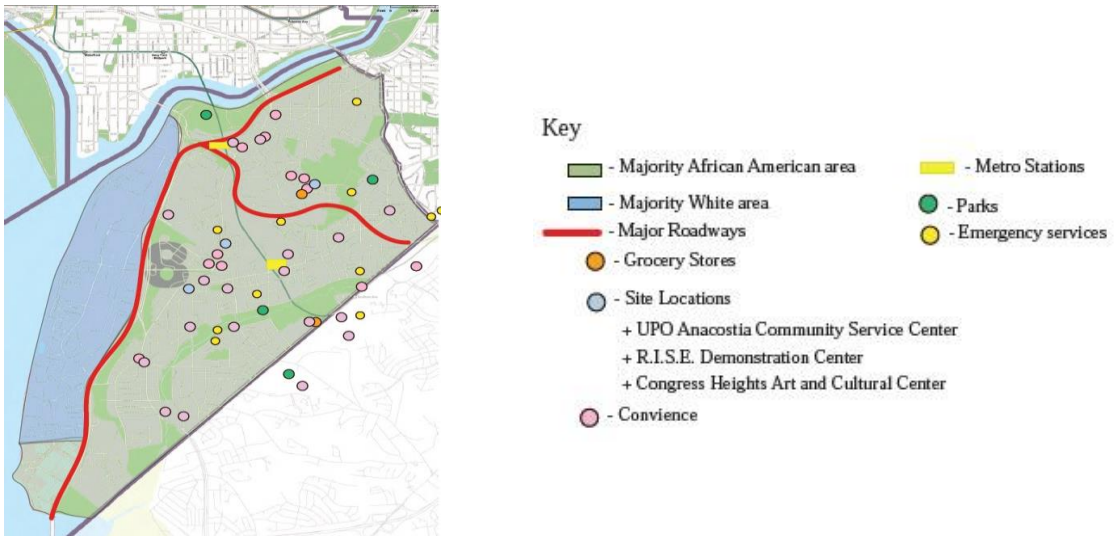


*Figure 4. Map of DC's Ward 8, showing case study locations, transportation, amenities, and demographics Source: DC Office of Planning*

## CASE STUDIES

The case studies that were chosen were The Congress Heights Art and Cultural Center, The R.I.S.E. Demonstration Center, and UPO Anacostia Community Service Center. The Congress Heights Art and Cultural Center's primary function is that of a museum, but it also hosts workshops and a number of community events. The R.I.S.E. Demonstration Center functions a demonstration space where a number of workshops are held and serves as the meeting of some of ward 8's governing committees. Lastly, The UPO Anacostia Community Service Center serves a number of different purposes such as education, housing, emergency services, youth development, and basic computer skills, this facility not only serves ward 8 but also Wards 6 and 7 as well.

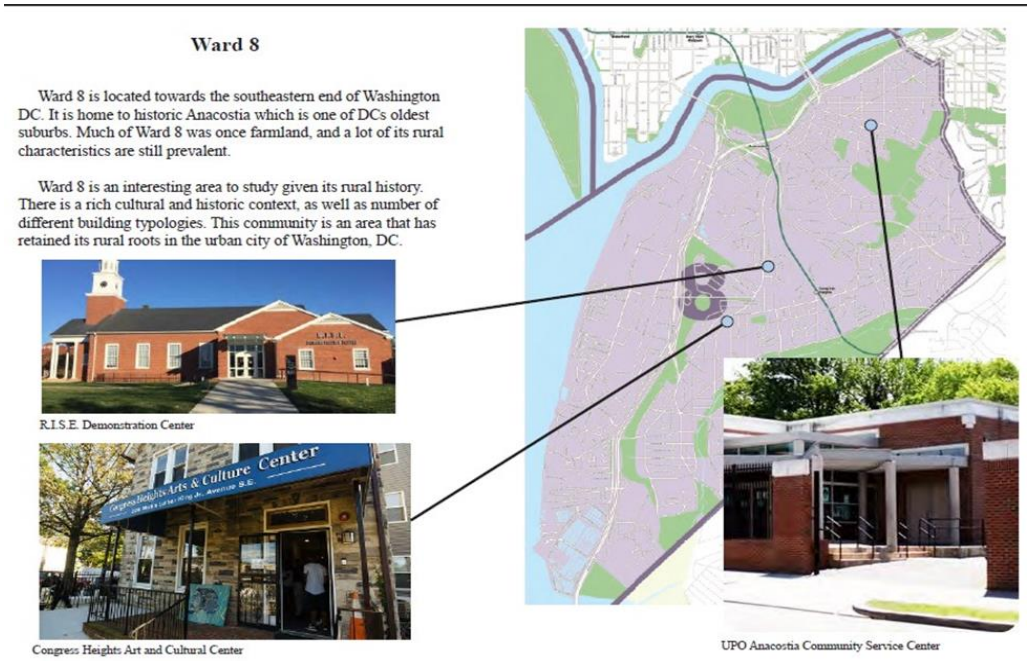


*Figure 5. Map of DC's Ward 8, showing case study locations, and brief description of Ward 8 Source: DC Office of planning*

## Community Survey

To explore the research question, case studies will examine development decisions and the processes by which community engagement and cultural considerations were included in three completed projects. Research documentation includes collecting information on the history of the building and its development. Data collection includes a site visit to survey the exterior and interior of the building with photographs. This documentation will be used to understand the architectural elements of the building. Surveys with the occupants at these facilities are planned. Data will be analyzed to identity all of the positive actions and attributes that were included in the projects' planning, design and construction. In addition to findings in the literature and information obtained from national experts, a list of suggestion will be developed using three themes: Historical Significance, Cultural Significance, and Societal Benefit.

This methodology was developed in phases. The study was initially centered around adaptive reuse. The case studies were originally intended to be adaptive reuse projects that showcased cultural consideration and the impact that has on a community. It was realized that adaptive reuse is only one example of development, and the study would be more impactful if it were broadened to development. There were interviews with key stakeholders and developers initially planned for this study. The interviews were replaced with a short survey that was given to occupants of the buildings being studied. Since this study's primary focus is the community, its only logical that the community is at the center of the research and that their opinions are considered. The surveys primary focus was to understand who these building are serving and how important are these buildings to the community.

The survey research questions were as follows:

1.How old are you?
2. What is your highest level of education?
3.Do you live Ward 8?
4.In what ways do you feel as though this building serves the community?
5.How often do you use this facility?
6.What do you use this facility for?
7.How would you feel if this facility were changed or destroyed?
8.Would you consider this facility to be an important part of the community?
9.Would you consider this facility to be cultural?
10.Rate the cultural significance of the facility.

## FINDINGS

The facilities being studied proved difficult to visit. The intention of this study was to visit each facility as it was being used, observed how they were being used, and conduct the survey with occupants. The fact that these facilities host a lot of events that where private, made them difficult to visit and observe. The only facility that was visited in this study was the R.I.S.E. Demonstration Center. Even though, the other facilities were not able to be visited, data from occupants was still collected. For the facilities that were not visited, ANC (Advisory Neighborhood Committee) meeting where attended. At ANC they discuss on going issues within the immediate and what has been done to help solve those issues. At these ANC meeting, which were conducted virtually, the survey was distributed.

The only facility that was visited was the R.I.S.E. demonstration Center. The event that was attended was the ward 8 health council meeting. During this meeting, issues revolving around ward 8's health was discussed from homelessness, crime, and even the ongoing Covid-19 pandemic. The facilitator of the event was disappointed by the participation say. "This place should be packed." The survey was distributed after the meeting and the data was collected. Surprisingly none of the survey live in ward

8, all of the surveyed simply used the building as meeting to organize event to aid ward 8 and even simply discuss the issues. Most of the surveyed had at least a master's degree. And even though all the surveyed felt as though the facility was important only about 50% believe that the facility was highly culturally significant.

The first ANC meeting that was attended was for ANC 8A which is where the UPO Anacostia community service center is located. The survey was distributed virtually during the ANC meeting. All of those surveyed live in Ward 8, this may be due to the fact that during these meeting, the community talks directly to their ANC leadership. The levels of education varied amongst those surveyed showing that no matter the level of education, the members of the community attend the ANC meetings to voice their opinions. The UPO Anacostia Community Service Center provides so many services that each if the surveyed had a different reason for using the facility. Most of the surveyed believed the facility was important to the community, and each felt differently about the cultural significance of the facility.

The last ANC meeting that was attended was for ANC 8C which is where the Congress Heights Art and Cultural Center is located. The survey was distributed virtually during the ANC meeting. This location proved to be the most difficult to collected data for and the survey participation was minimal. Only one of those surveyed live in Ward 8, this may be due to the fact that one of the surveyed was the owner/ operator of the facility. The levels of education varied amongst those surveyed. Both of the surveyed had a different reason for using the facility. One of the survey felt as though the facility was important to the community while the other was not sure, and each felt differently about the cultural significance of the facility.

## CONCLUSION

Based on the research, it can be concluded that each of these facilities is important to the immediate community, even if the community is split on the facility's cultural significance. The occupants of these facilities may not always live within the immediate community but that does not mean that their presence isn't important. Developers should be mindful of a few things before making decisions. (1) Understand the immediate community's needs. Study the area and understand exactly what issues are present and see if there is a way to help mitigate the issues through design. (2) Include community participation within your research. Doing research before presenting a proposal for a master plan or new facility is a great way to make sure that you are meeting community needs. However, the research is never fully complete if the community's opinion is not taken into account, a disregard for the community's opinion can have disastrous effects. (3) Make an effort to preserve a community's cultural identity. Some existing building have a lot of historical and cultural value, if a designer is making a change to an existing building, they should try to preserve as much of the architectural integrity as possible. (4) Understand what a facility was used for. If a proposal is made to tear down an existing facility and replaced it with a new facility, the new facility has to benefit the community in some way. If the previous facility provided an important service, a new facility put in its place has the potential to provide more or less to the community. It is more beneficial if the facility provides more. (5) Developers should no longer prioritize profit over community need. It is possible for a project to be economically sustainable, while still being socially and culturally sustainable. Community based design should be the norm with environmental design.

## NOTES

[1] David S. Rotenstein, “The Decatur Plan: Folklore, Historic Preservation, and the Black Experience in Gentrifying Spaces.” Journal of American Folklore 132 (526): 431–51. doi:10.5406/jamerfolk.132.526.0431.
[2] Michael Atwood Mason et. AL. “Cultural Sustainability: A Framework for Relationships, Understanding, and Action.” Journal of American Folklore 133 (527): 81–105. doi:10.5406/jamerfolk.133.527.0081.
[3] M. Reza Shirazi et AL. “Critical Reflections on the Theory and Practice of Social Sustainability in the Built Environment – a Meta-Analysis.” Local Environment 22 (12): 1526–45. doi:10.1080/13549839.2017.1379476.
[4] Yingjie Hu et AL. . “The Unintended Consequences of a Culture-Led Regeneration Project in Beijing, China.” Journal of the American Planning Association 82 (2): 148–51. doi:10.1080/01944363.2015.1131130.
[5] Ahmadreza Shirvani Dastgerdi et AL. “Improving Cultural Heritage Policy for the Preservation of Historic Minority Quarters.” International Journal on Minority & Group Rights 27 (3): 645–61. doi:10.1163/15718115-02704003.
[6] Erica Avira, “Making Historic Preservation Sustainable.” Journal of the American Planning Association 82 (2): 104–12. doi:10.1080/01944363.2015.1126196.

## BIBLIOGRAPHY

Avrami, Erica. 2016. “Making Historic Preservation Sustainable.” Journal of the American Planning Association 82 (2): 104–12. doi:10.1080/01944363.2015.1126196.

Dastgerdi, Ahmadreza Shirvani, and Giuseppe De Luca. 2020. “Improving Cultural Heritage Policy for the Preservation of Historic Minority Quarters.” International Journal on Minority & Group Rights 27 (3): 645–61. doi:10.1163/15718115-02704003.

Hu, Yingjie, and Emma Morales. 2016. “The Unintended Consequences of a Culture-Led Regeneration Project in Beijing, China.” Journal of the American Planning Association 82 (2): 148–51. doi:10.1080/01944363.2015.1131130.

Mason, Michael Atwood, and Rory Turner. 2020. “Cultural Sustainability: A Framework for Relationships, Understanding, and Action.” Journal of American Folklore 133 (527): 81–105. doi:10.5406/jamerfolk.133.527.0081.

Rotenstein, David S. 2019. “The Decatur Plan: Folklore, Historic Preservation, and the Black Experience in Gentrifying Spaces.” *Journal of American Folklore* 132 (526): 431–51. doi:10.5406/jamerfolk.132.526.0431.

Shirazi, M. Reza, and Ramin Keivani. 2017. “Critical Reflections on the Theory and Practice of Social Sustainability in the Built Environment – a Meta-Analysis.” Local Environment 22 (12): 1526–45. doi:10.1080/13549839.2017.1379476.

# HEALING OR TRANSFERRING TRAUMA?: EXPLORING THE HEALING CAPACITY OF LULLABIES FOR DISPLACED ARTSAKHI MOTHERS

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## INTRODUCTION

In 2020, the number of forcibly displaced people surpassed 80 million at mid-year.[1] Conflict is one of the reasons why people are forced from their homes. In post-conflict settings, there is an irreplaceable loss of lives, land, territory, landscapes and monuments. The affected communities are very vulnerable and often suffer from trauma, posttraumatic stress disorders (PTSD) and psychological or physical wounds, huge material and human loss, destruction of their tangible property, assets and heritage, and separation from their land. According to a study by the World Health Organization, the exposure to a humanitarian crisis, particularly to armed conflict, leads to the development of severe mental disorders on average for five percent of the population in conflict areas, and moderate mental disorders for the 17 percent of the people.[2] In 1998, MSF formally recognized services to address and alleviate the mental health psychosocial needs of people who suffer from conflict and displacement, as part of their emergency work.[3]

Though mental health interventions are recognized as part of the emergency work and increasingly evaluated, they often face limitations, in terms of time, organization, insufficient resources, accessibility in remote or insecure areas and lack of psycho-education.[4] Moreover, in many contexts, it is questionable whether western approaches of psychological and psychiatric support are socially and culturally appropriate and are able to overcome the barrier of people's fear of social stigma associated with mental health issues.[5]

There are several tools and approaches that could enhance the efficiency of humanitarian response related to mental health services and community post-conflict healing. In the last two decades, “cultural aid” has been part of the international responses to post-conflict recovery, offering music and other arts activities.[6] According to Gillian Howell, one of the “four broad categories of intentions” that “underpin cultural interventions in conflict-affected settings”, is “Healing, Health and Well-Being”.[7] However, the humanitarian response has prioritized basic physiological needs while cultural sensitivity, symbolic repair and reconstruction of cultural assets have been often neglected.

Furthermore, the value of ICH is not sufficiently explored within academia as a tool for healing, and there is a lack of knowledge related to the assessment of the benefits that it might encompass. In this regard, this research seeks to explore the potential of traditional lullabies as a tool for healing post-conflict trauma, for the affected communities.

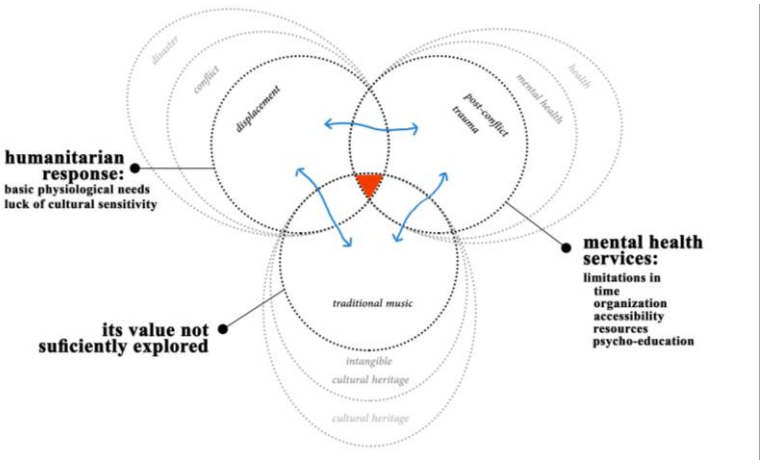


*Figure 1. Diagram of research problem by Leda Depasta*

Consequently, this research intends to explore, analyze and bridge the existing gaps between post-conflict humanitarian response, mental health and ICH, aiming to raise awareness and stress the importance of integrating ICH in the humanitarian response, already from the emergency phase. Therefore, delving into this field of research, the general objective is to assess the healing capacity of ICH, specifically traditional lullabies, for the displaced communities from Artsakh that suffer from post-conflict trauma, due to the Nagorno-Karabakh war 2020.

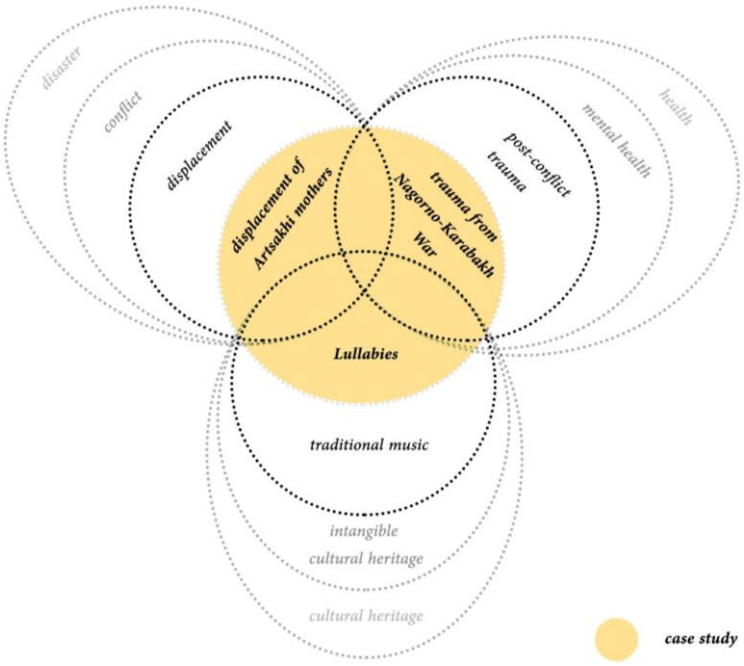


*Figure 2. Conceptual framework of the research and selected case study by Leda Depasta*

The specific objectives of the research are, first, to describe and assess the post-conflict trauma of the displaced communities from Artsakh, and, secondly, to analyze how traditional lullabies from Artsakh may help to mitigate and heal the trauma after the Nagorno-Karabakh war 2020.

## CASE STUDY

Artsakh or Nagorno-Karabakh is a very mountainous, small, landlocked region and disputed territory to the east of Armenia in the South Caucasus.

*Figure 3. "Grandma and Grandpa: We Are Our Mountains", landmark of Artsakh by Leda Depasta*

### The conflict

In September 2020, an armed conflict erupted, which lasted 44-days.[8] The territory was internationally recognized as part of Azerbaijan, but was populated, supported and controlled by ethnic Armenians.[9] According to the New Humanitarian, the war forced the displacement of 90,000 ethnic Armenians that fled Nagorno-Karabakh, going to Armenia.[10]

Due to the complicated political situation, ethnic Armenian displaced people couldn't be called refugees, or internally displaced persons (IDPs), and therefore, their status right after the eruption of the war, was "spontaneously arrived people"[11]. Now they are called "persons in a refugee-like situation" (PRLS).[12]


*Figure 4. Case study: geographic location and conflict by Leda Depasta*

### Artsakhi mothers

Artsakhi mothers were forcibly displaced from Artsakh, among other 90,000 displaced people. They were identified as the most affected group by the Nagorno-Karabakh war 2020. They had to flee, leaving behind their belongings, their home and their land, their livelihoods and most of them their husbands, sons, or brothers, who had to fight in the frontline. At the same time, they had to find a safe place to stay, for their children and themselves, during their spontaneous arrival in Armenia, seeking support from local NGOs, cultural and sport centers, hotels and hosting families.

### Lullabies

It is well known that music tradition is particularly embedded in the Armenian and Artsakhi culture and lullabies, specifically, have significant importance. They were sung from mothers as a bridge for the kid to sleep and at the same time, through lullabies, they were expressing their thoughts and struggles about life. It was a process of sharing collective memories and narrating stories or historical facts, preserving their identity, creating a sense of belonging, and alleviating their pain. Thus every song had its own history and its unique process of creation.

In terms of musical structures and musical thinking, every region had its own unique formula, melody, key, tonality, articulation and dialect, due to the diverse geographic landscape. However, intrinsic element of all lullabies was the repetition and small variations from one specific note, without a strict rhythmical pattern, creating a repetitive and meditative effect.

## METHODOLOGY

KASA Swiss Humanitarian Foundation, was the main local partner, supporting the field research in Yerevan, in Armenia.

### Sample

The sample included three different groups. The first group was the displaced Artsakhi mothers, with kids up to 12 years old, that were the focus group of the research and were directly affected by the war. The second group included key informants, that were not directly affected by the war, but were involved in the emergency response and worked directly with the beneficiaries, as humanitarian experts or music experts, and the third was composed by key informants that were lullaby experts, as a primary source for understanding about lullabies and their potential in the specific post-conflict and cultural context.

### Data collection tools

Two data collection tools were used: one-to-one, semi-structured in-depth interviews, addressing to key-informants involved in the humanitarian response, psychologists and lullaby experts, and online questionnaires addressing to Artsakhi mothers. The data collection process lasted one month, seven interviews were conducted in total with female participants, and four questionnaires were filled out by Artsakhi mothers. For both data collection methods, content analysis was conducted.

## RESULTS

An overview of the results' analysis is illustrated in the diagram of Figure 5, providing a more detailed structure of the research. Starting from the general objective, and splitting it into two more specific ones, the process of the research is represented, leading to three dimensions of analysis for each one of the specific objectives, and setting distinct indicators for every dimension, to organize the data analysis.

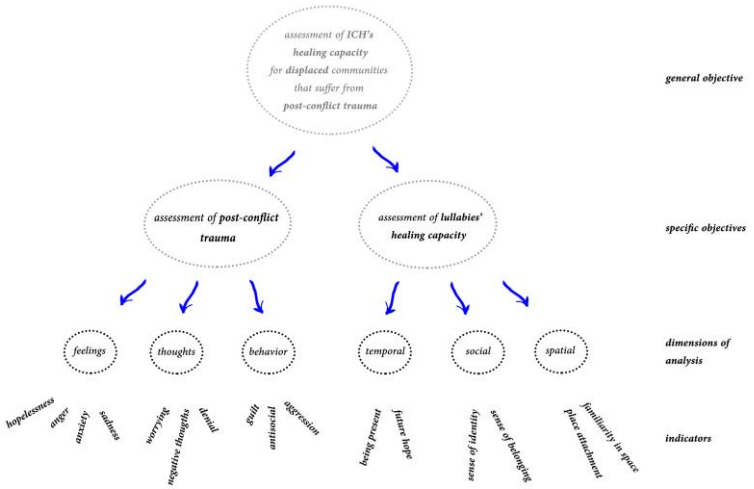


*Figure 5. Diagram of analysis – objectives, dimensions, indicators by Leda Depasta*

## Post-conflict trauma asessment

The trauma of Artsakhi mothers was analyzed through its impact on feelings, thoughts and behaviors and by understanding the multiple effects of the war on them, through the trauma of their children and husbands as well.

### Mothers

Artsakhi mothers were experiencing difficulties with sleeping, resting, eating and having a daily routine. As illustrated in Figure 6, signs of trauma on their feelings included irritation, sensitivity, emotional suffering from loss, disappointment, tension, tiredness, anxiety, anger and fear of going back and see their hometown from far away, without being able to approach. Some, expressed hope for the future, attempting to restart their lives. Their thoughts were reflecting their worries about their family members, uncertainty about what to do after and hopelessness as they might haven't heard news about their sons or husbands in the frontline. Often, though, they would express thoughts of pride, praising their soldiers for their braveness during previous wars. Their trauma had impact on their behavior, as they were demonstrating indifference, lack of energy, obsessive behaviors, aggressiveness and violence towards their kids. However, this was contradicted based on their assumption that their kids were their priority regardless of the ongoing tough situation.

### Children

Among their children, the most common symptoms of trauma were anxiety, restlessness, unwillingness to speak and different types of fears, especially sound sensitivity, that caused panic attacks. They were often asking, “What will we do, why father can't talk with us, we are waiting for his call.” They also expressed hope at the same time, “We will go back and we will be able to eat apples again from our trees.” Their hope, however, was combined with intense spirit of war.

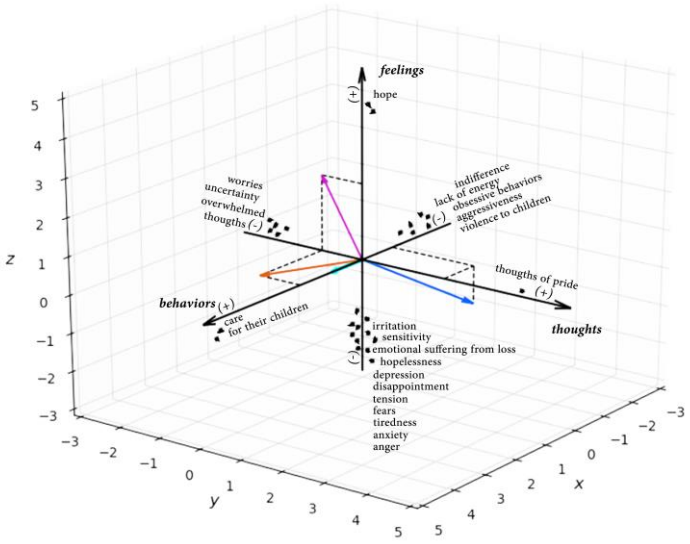


*Figure 6. Dimensions of analysis: signs of trauma in Artsakhi mothers by Leda Depasta*

### Teenage boys

This was even more intense among teenage boys, as they would release their frustration through aggressive and obsessive behaviors. Most of them would even experience huge feeling of guilt or jealousy for not being able to go to the war, while their older friends were there, fighting in the front line. Going to war was perceived as proof of strength, braveness, maturity and masculinity and the boys, even from young age they were already considered to be a "future soldier", demonstrating some kind of "glorification of the soldier protecting the borders".

### Husbands

Artskahi mothers, were, as well, affected by the signs of trauma on their husbands who survived the war. Most of them suffered from physical trauma but also from huge mental trauma, after experiencing traumatic events during the war. Their trauma was expressed through gender-based violence or other unhealthy self-coping mechanisms.

### Collective trauma

Moreover, it was found that the war, had deeply affected everyone in the country and everybody was somehow traumatized, even if not primarily affected by the war. Not only, because almost everyone lost somebody, but also because of this uncertainty for the future and the frequent incidents in the borders, reminding the days of the war and re-triggering the trauma.

### Trans-generational trauma

Additionally, a trans-generational trauma was detected, related to the history of the country, that was carried and experienced from previous generations. This suffering has actually been deeply embedded in the culture and imprinted in the oral traditions.

### Stigmatization of trauma

Last, the fear of social stigmatization due to trauma was found, affecting the access to mental health services and psychosocial support, thus rendering lullabies an alternative and contextually relevant tool for investigating their healing capacity.

## Lullabies' healing capacity assessment

Regarding the lullabies' healing capacity assessment, three healing dimensions of traditional lullabies were identified; temporal, social and spatial dimension. During the data collection process, Artsakhi mothers were asked to choose one lullaby from Artsakh, explaining how they felt after listening to it, by answering specific questions related to the indicators of time, social life and space.

### Temporal dimension

Regarding the temporal dimension, Artsakhi mothers were asked to express if they felt more connected to the past, to the present or future, after listening to the lullaby. As conceptually represented in Figure 7, all participants focused on the past, and even if they expressed positive feelings, it contradicted the power of lullabies to mitigate the attachment to the traumatic past.

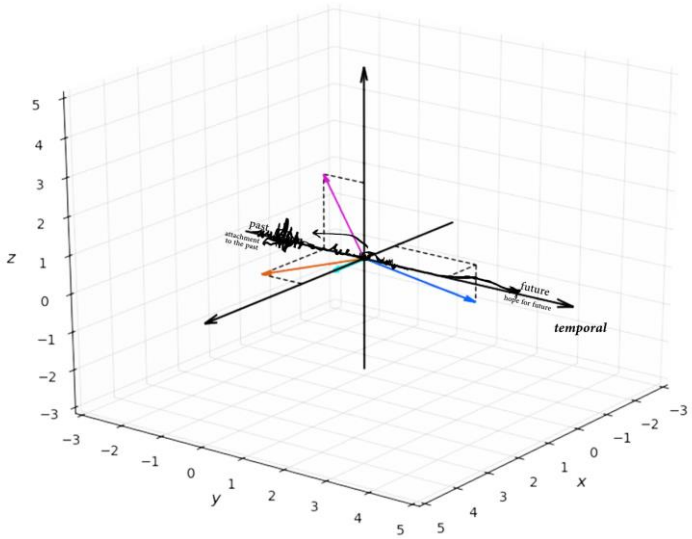


*Figure 7. Conceptual diagram of lullabies' healing capacity: temporal dimension by Leda Depasta*

This could be understood by their answers, "I was singing this lullaby to my kids […] but now, that melody reminds me of my home, my peaceful life." Another mother pictured herself standing on the edge of a mountain, in her hometown called Sushi, "I am standing, with my arms open, fresh air enters my lungs, I feel lighter, my stressful state disappears for a moment." Artsakhi mothers expressed that singing lullabies could create hope, expectations and confidence about a better future, thus allowing them to rebuild their life with more motivation. However, it was not clearly proved that they could contribute to mothers' capacity to adapt to the change, to cope with the traumatic past and to relate to the past, present and future in a healthier way.

### Social dimension

As far as it concerns the social dimension, lullabies can contribute to the healing process, through creating or strengthening social bondings, enhancing the sense of belonging and collective identity. One Artsakhi mother mentioned, "I was listening to that lullaby during the war, because I wanted to be connected and engaged, but not in a panicked way; to feel connected to the nation and to the situation. Because I didn't want to get out of reality […] I also wanted to be on the ground. And I felt connected with all the people, not only with my nation. I am feeling something that is connecting all of us." The main healing elements that were mentioned from the mothers included "the collective

memory", "the origins of the lullaby", "the content", "the words and their meaning", "the values", "the courage" and "the sense of pride" that were conveyed through the lullabies. A mother explained that she was experiencing a healing process because she really felt "connected to the singer's story", while another one stated, "This song is close to my heart, maybe because it is written in the Artsakh dialect," hence, indicating the perception of language as a bridge to their home and culture.

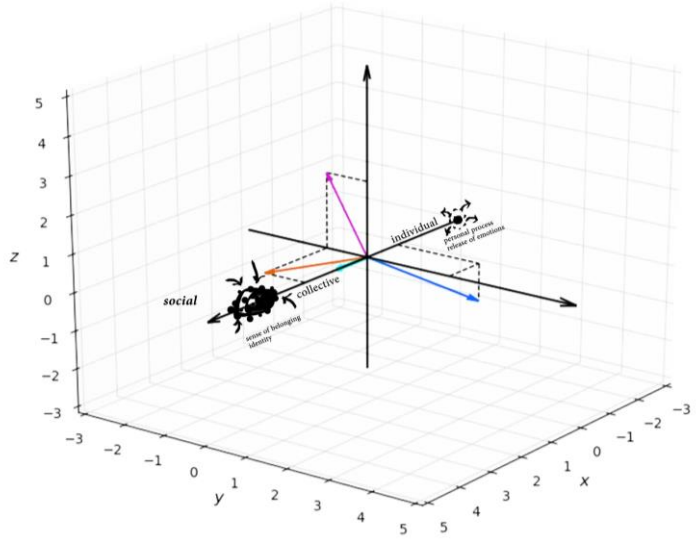


*Figure 8. Conceptual diagram of lullabies' healing capacity: social dimension by Leda Depasta*

However, singing lullabies, was rather an individual process, as most of the mothers pictured themselves being alone, "I feel more attached to myself when I am singing a lullaby", "I am singing for myself", "I can relate my personal story to this lullaby", indicating a personal and intimate connection between lullaby and mother. Furthermore, the function of lullabies, traditionally and culturally, served as a self-coping method and was relieving and alleviating. In fact, mothers used to heal themselves, by expressing and releasing the loads of everyday life, through singing about their struggles, anxieties and concerns, because they were not allowed to talk about them or complain in the house, "I sing when I want to calm my feelings", "I sing when I am sad", "During the war time, I just wanted to get distracted. I wanted something very spiritual. It was the only way to release the stress." Through lullabies mothers are becoming stronger and healing themselves.

This psychosocial function and therapeutic purpose of lullabies, could confirm that it was an individual process that could relieve from the social pressure, but simultaneously could help relate in a better way with the collective life, therefore, achieving a more balanced or sustainable relation between the individual and the collective dimension. One of them explained: "First, you are connected to yourself, because it is the main state, so that you can be connected to another person and then be connected to the whole universe in general."

### Spatial dimension

In terms of spatial dimension, lullabies serve as a bridge between physical space and movement, therefore the tangible dimension, and the immaterial world of dreaming, which is intangible.

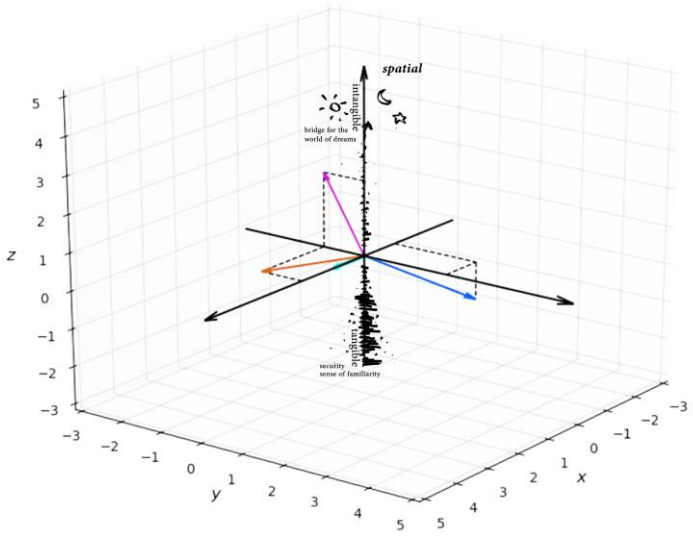


*Figure 9. Conceptual diagram of lullabies' healing capacity: spatial dimension by Leda Depasta*

After listening to the lullaby, all mothers imagined an "existing place", which meant that they could clearly relate with familiar images and already experienced situations. They felt "security", "hope" and "peacefulness", "familiarity" and "place attachment", which could ease negative feelings, increasing feelings of comfort and safety in a new place and creating peaceful thoughts.

Furthermore, it was identified that lullabies can heal sleeping disorders, for both mother and kid, facilitating the transition to the intangible dimension of sleep with the slow meditative rhythm and the particular comforting and restoring movement in the hug of the mother, like a spiral movement, which is very much connected to nature and geometry. The mother would often urge her kid to escape from the real world, immersing in the intangible world of dreaming. The prevailing narrative, was praising the kid: "You are not actually anything earthy. You are like the sun, you are like the moon, you are like the stars. You are perfect. Only to those elements you can be compared. Only with them you have to play, because they are as perfect as you are."

### Contesting lullabies' healing capacity

Apart from the aforementioned healing dimensions of lullabies, some controversial elements were identified, questioning their healing capacity.

In fact, it was found that lullabies can perpetuate the trans-generational trauma already carried throughout generations. Every mother would put part of herself and her emotions, letting fundamental historical information pass through, while raising awareness about the enemies and through that transformation she would heal herself, giving to the next generation another song, that could transfer the trauma, as conceptualized in Figure 10.

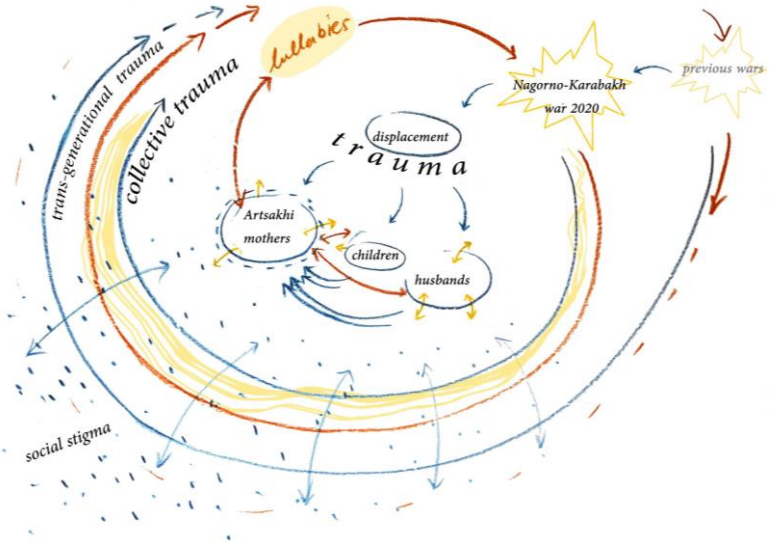


*Figure 10. Conceptual diagram: the circle of trauma by Leda Depasta*

Furthermore, lullabies might perpetuate a national and non-peaceful spirit, as there were "narratives about the enemies, that were being told from a young age, so that the kid would be able to protect when he would grow up." In fact, it was important to be vigilant because of the geographic position of this region. However, lullabies did not actually promote a spirit of violence or war, but it was more about protecting and defending the borders, as well as about peaceful work and existence, about prosperous family and shouldering your father as a son. This content could encourage mothers to accept that they were raising their sons with the purpose of becoming future soldiers, thus alleviating the suffering about their potential loss.

Last, it was found that lullabies promoted socially and culturally accepted roles related to genders, reproducing, consolidating and transferring to the next generations specific ways of thinking, behaving, and living, thus perpetuating the perceptions of gender roles in their society. Furthermore, there was more importance given to the boys by the mothers, and therefore the content of lullabies was mainly referring to them, because girls by default, from their birth, were considered not to be theirs, since at some point they were supposed to become the wife of another person and leave the family.

## CONCLUSION

To conclude, the multidimensional approach to intangible cultural heritage, partially proved the capacity of lullabies to heal post-conflict trauma. It revealed the lullabies' power to prepare mother and kid for the war, functioning as a source of knowledge and preservation of culture. Interestingly though, the capacity to heal trauma is contentious, as lullabies were created in order to cope with war and release pain from trauma and struggles, while through them the trauma is actually being transferred to the next generations. Therefore, beyond oral traditions that convey diverse connotations and messages through the language, other elements of ICH could be explored for post-conflict healing, which embody more peaceful cultural connotations.

## NOTES

[1] "Refugee Data Finder," UNHCR, accessed June 9, 2021, https://www.unhcr.org/refugee-statistics/.
[2] Fiona Charlson et al. "New WHO Prevalence Estimates of Mental Disorders in Conflict Settings: A Systematic Review and Meta-Analysis," The Lancet (2019): 240-248*,* accessed June 11, 2021, doi:10.1016/S0140-6736(19)30934-1.
[3] "Mental Health: Beyond a Healthy Body," MSF, accessed June 9, 2021, https://www.msf.org/mental-health-depth.
[4] "Assessing Mental Health and Psychosocial Needs and Resources - Toolkit for Humanitarian Settings," UNHCR, accessed June 28, 2021, https://www.refworld.org/docid/55b889c34.html.
[5] Derek Summerfield, "Conflict and Health. War and Mental Health: A Brief Overview," *BMJ* 321 (2000): 235, accessed June 10, 2021, https://www.researchgate.net/publication/12415004_War_and_mental_health_A_brief_overview.
[6] Gillian Howell, "Community Music Interventions in Post-Conflict Contexts," The Oxford Handbook of Community Music, (2018): 43, accessed June 11, 2021, doi:10.1093/oxfordhb/9780190219505.013.21.
[7] Gillian Howell, "Community Music Interventions in Post-Conflict Contexts," The Oxford Handbook of Community Music, (2018): 45-46, accessed June 11, 2021, doi:10.1093/oxfordhb/9780190219505.013.21.
[8] "The Nagorno-Karabakh Conflict: A Visual Explainer," International Crisis Group, accessed June 11, 2021, https://www.crisisgroup.org/content/nagorno-karabakh-conflict-visual-explainer.
[9] Andrew Connelly, "The Humanitarian Fallout of the Nagorno-Karabakh Conflict," The New Humanitarian, accessed June 11, 2021, https://www.thenewhumanitarian.org/news-feature/2020/11/5/nagorno-karabakh-armenia-azerbaijan-conflict-humanitarian-impact.
[10] Andrew Connelly, "The Humanitarian Fallout of the Nagorno-Karabakh Conflict," The New Humanitarian, accessed June 11, 2021, https://www.thenewhumanitarian.org/news-feature/2020/11/5/nagorno-karabakh-armenia-azerbaijan-conflict-humanitarian-impact.
[11] "IOM Armenia: Nagorno-Karabakh Conflict - Situation Update (08 October 2020)," *ReliefWeb,* accessed June 10, 2021, https://reliefweb.int/report/armenia/iom-armenia-nagorno-karabakh-conflict-situation-update-08-october-2020.
[12] "Armenia: Inter-Agency Operational Update April 2021," UNHCR, accessed June 10, 2021, https://data2.unhcr.org/en/documents/details/87034.

## BIBLIOGRAPHY

Charlson, Fiona et al. "New WHO Prevalence Estimates of Mental Disorders in Conflict Settings: A Systematic Review and Meta-Analysis." The Lancet (2019): 240-248, 394(10194). Accessed June 11, 2021. doi:10.1016/S0140-6736(19)30934-1.

Connelly, Andrew. "The Humanitarian Fallout of the Nagorno-Karabakh Conflict." The New Humanitarian*,* November 5, 2020. Accessed June 11, 2021, https://www.thenewhumanitarian.org/news-feature/2020/11/5/nagorno-karabakh-armenia-azerbaijan-conflict-humanitarian-impact.

Howell, Gillian. "Community Music Interventions in Post-Conflict Contexts." The Oxford Handbook of Community Music, 2018. Accessed June 11, 2021. doi:10.1093/oxfordhb/9780190219505.013.21.

International Crisis Group. "The Nagorno-Karabakh Conflict: A Visual Explainer." May 7, 2021. Accessed June 11, 2021. https://www.crisisgroup.org/content/nagorno-karabakh-conflict-visual-explainer.

IOM. "IOM Armenia: Nagorno-Karabakh Conflict - Situation Update (08 October 2020)." ReliefWeb, October 8, 2020. Accessed June 10, 2021. https://reliefweb.int/report/armenia/iom-armenia-nagorno-karabakh-conflict-situation-update-08-october-2020.

MSF. "Mental Health: Beyond a Healthy Body." November 9, 2018. Accessed June 09, 2021. https://www.msf.org/mental-health-depth.

Summerfield, Derek. "Conflict and Health. War and Mental Health: A Brief Overview." BMJ 321 (2000): 232–5. Accessed June 10, 2021. https://www.researchgate.net/publication/12415004_War_and_mental_health_A_brief_overview.

UNHCR. "Assessing Mental Health and Psychosocial Needs and Resources - Toolkit for Humanitarian Settings." 2012. Accessed June 28, 2021. https://www.refworld.org/docid/55b889c34.html.

UNHCR. “Refugee Data Finder.” December 8, 2020. Accessed June 9, 2021. https://www.unhcr.org/refugee-statistics/.

UNHCR. “Forced Displacement Passes 80 Million by Mid-2020 as COVID-19 Tests Refugee Protection Globally.” December 9, 2020. Accessed June 09, 2021. https://www.unhcr.org/news/press/2020/12/5fcf94a04/forced-displacement-passes-80-million-mid-2020-covid-19-tests-refugee-protection.html.

UNHCR. “Armenia: Inter-Agency Operational Update April 2021.” April 2021. Accessed June 10, 2021. https://data2.unhcr.org/en/documents/details/87034.

UNHCR. “Armenia Inter-Agency Operational Update, 1-28 February 2021.” March 22, 2021. Accessed June 11, 2021. https://reliefweb.int/report/armenia/armenia-inter-agency-operational-update-1-28-february-2021.

# MAKING A CHANGE: ADVISING ELEMANTARY SCHOOL'S ON NAVIGATING COVID-19 BY CREATING A "NEW STANDARD OF EDUCATION"

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## INTRODUCTION

In the United States, COVID-19 stopped time - closing public schools, forcing emergency remote instruction and prompting a critical assessment of safety, modernization investment needs required for re-occupancy of these facilities. Even before the coronavirus pandemic prompted a widespread sense of urgency for safety, the American Society of Civil Engineers (ASCE) assessed the U.S. public school system's infrastructure as poor, due to falling levels of public investment needed to correct leaky roofs, rusty plumbing, mold and mildew, and broken heating and cooling systems. "In 2017, the ASCE gave the U.S. public school system a D+ on its "Infrastructure Report Card" issued every five years. Fifty-three percent of schools, the report found, need improvements just to rise to a ranking of "good" condition. Twenty-four percent were rated "fair" or "poor." Thirty-one percent had temporary buildings—which spikes the "fair" or "poor" rate to 45 percent. And 40 percent of schools lack a long-term educational facility plan to address these challenges".[1] During the pandemic elementary school children in under-served communities, and long-term users of deteriorated facilities, suffered from an overall lack of access to education due to public school closures and gaps in technology hindering virtual instruction. Compounding these challenges, children also were more at risk to contract the coronavirus disease. Research conducted by Children's National Hospital in Washington, D.C., found racial disparities in how the coronavirus affects children. Researchers discovered that children from minority groups were most at risk; 7% of white children, 30% of Black children, and 50% of Hispanic children evaluated positive.[2]

This is a national issue – unacceptable public-school infrastructure, inflexible instruction modalities, and vulnerable school age populations with health outcomes hindering education. To address this issue and mitigate future pandemic impacts, a New Standard of Education is proposed that reimagines delivery methods for teaching and provides innovative, flexible, safe, and sustainable environments for children.

## MAKING THE CHANGE

There is a need for change from this "cells and bells" manner that the United States currently uses within its school system. The term "cells and bells" compares the characteristics of a prison. Both places have authoritarian structures, a dress code, emphasis on silence and order, walking in lines, set

schedules, and loss of individual autonomy. The world is constantly changing, and today the world is currently in the fourth industrial revolution. We have advancements in science, technology, and medicine, there is no reason the education system cannot evolve either.

Within school, there are two different networking systems. The first is the classical hierarchical network based on old traditions and thinking. The classical approach is an American history-based, idea-centered educational model in which the students have introduced the influential minds of the past through literature, essays, philosophy, etc. It has been successfully used to educate students for centuries and has produced many of history's great minds. These great minds have done a lot, but they have not found solutions for issues our country now faces. For example, issues like poverty, social/racial injustice, and classism are significant issues within the U.S. These socioeconomic status issues can comprise the value of life characteristics and the opportunities and privileges afforded to people within the U.S. society.

Poverty is not a specific factor but is characterized by numerous physical and psychosocial stressors. Socioeconomic status is a consistent predictor of various outcomes across the life span, most important physical and psychological health. Thus, socioeconomic status applies to all behavioral and social science areas, involving research, practice, advocacy, and, most importantly, education.

The second is a more modernized approach, called open networking. This type of approach allows resources and assistance to meet available to everyone. It is an atypical approach centered around being a resource for the students at the school and the entire community. This is the new direction our nation's school system needs to adopt, creating learning communities for the students and their loved ones. There is a need to adjust the learning mode within this networking system.

## MODES OF LEARNING

There are four different modes of learning: hierarchical individual, hierarchical collective, distributed individual, and distributed collective.

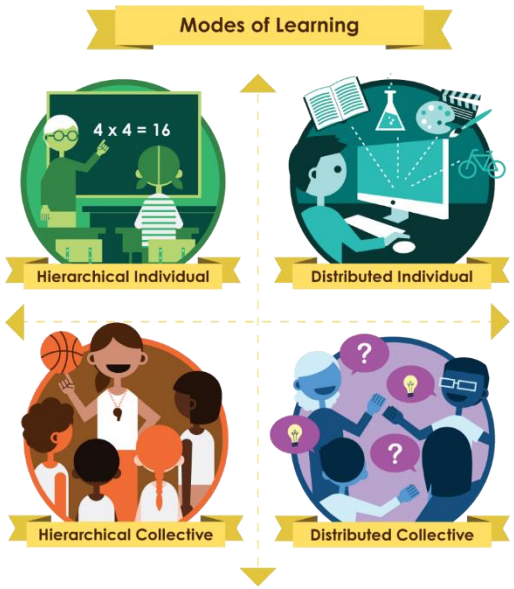


*Figure 1.1 Modes of Learning - Ikem, O. V. (2016, September 3). Explore your theory of learning. Medium. Retrieved January 23, 2022, from https://medium.com/technology-learning/explore-your-theory-of-learning-765aa163ee14*

1. Hierarchical Individual- recognizes that the teacher is giving direction to the student. The students are given information in a particular sequence/ structure. "Individuals learn academic content in

chronological order from basic to advanced, measured and assessed. Individuals are responsible for their success as learners while school staff is accountable for measurable growth in individual learning".[3] In this learning mode instructionally, the educator delivers the lesson and knowledge the students must acquire while individual learners participate in their academic work. This in turn, mandates the students to have strong guidance to learn appropriately.

2. Hierarchical Collective – recognizes the value of the hierarchal position in power and acknowledges the importance of the children and wants to improve the world. "Learning is still defined by the idea that there is a particular structure and sequence to knowledge but emphasizes learning as a communal activity as opposed to an individual activity".

3. Distributed Individual – recognizes that today's world is vastly different, whereas teachers were the gateway to knowledge, but now knowledge and information are freely available. In this mode, the school is not the source of knowledge but a gateway. Students are allowed to take advantage of learning outside of school, becoming an agent of knowledge. "It is most familiar to those who use digital learning. It assumes that individuals are natural learners and can make judgment about what knowledge is helpful and of interest to them. However, learners must make sense of competing and diverse sources of knowledge, skill, and expertise while determining success based on their goals and ambitions".

4. Distributed Collective – strays away from the traditional power dynamic between teacher and student. They work as a collective to achieve a common goal, and everyone contributes to the learning experience. "In this quadrant, networks are the new classroom. These networks consist of people with varying degrees of knowledge and expertise, and members take on both learning and teaching roles to maintain the network's strength as a community. Success is determined by the learning community and its members and is based on collective interests and priorities".[4]

## LEARNING SPACES

The place in which education is taught is just as important as a method of delivery of the curriculum and the mode of learning. Covid-19 has made way for a shift in our schools' paradigms and has allowed us to reshape our modalities. Of all the models for defining learning spaces, the best by far comes from the studies of David Thornburg. He utilizes a straightforward, four aspect approach to describing learning spaces. Thornburg notes that in a time of continuous change, these four learning styles have remained analogous overages. These four styles are the following:

**The campfire –** is the place where students congregate to hear the teacher's knowledge. In long-ago times, this was where people assembled to listen to the storyteller, who was the bestower of wisdom in the community. Today, students need direct instruction; and the campfire space happens. "Nowadays, the fire has been replaced with a data projector and screen, or an interactive whiteboard, but the concept remains the same".[5]

**The watering hole** - is the place for social understanding and experiences. Since conversation requires a different way of thinking than when we are alone, dialogue establishes knowledge. Social education is essential to education; lacking time spent talking and discussing learning with others, students are not required to reach the next level in their comprehension. From a design standpoint, the question is:" Does the learning space being created offer ways for students to gather in these small groups comfortably and safely to solve problems and discuss their learning?" Thornburg implies that "in several school circumstances, the opportunity to communicate is so limited that this is the reason why school hallways and social spaces are so noisy".

**The cave** - is the home of reflective learning; it is where students work alone, making worth and giving a purpose to their education, collaborating with outside resources (e.g., books, websites etc.). Thornburg alludes that if the campfire is home to the lecture and the watering hole home to dialogue,

the cave is home to the cognitive digestion of understanding the latest information. "More than often, we associate learning only with doing – and see quiet thinking as 'doing nothing' – how often has someone come up to you while you are sitting quietly and say, hey, can I interrupt you while you aren't busy? In a library, we traditionally have silent study spaces; but in the classroom, where a lot of learning takes place, we do not offer this opportunity". It is especially crucial for introverted students. We need to acknowledge the significance of imagining and knowledge synthesizing as part of the learning process, vigorously teach it to the children, and the chance to encounter a quiet space.

**Life** - is the most overlooked space in the classroom; so often, we see the classroom as separate from 'real life' practice when it takes up so much of children's lives. As a result, the chance to get hands-on and use the knowledge in an applicable situation decreases over time. "Currently there is a lot of interest in maker spaces, which are a terrific example of learning through doing – and as technologies become increasingly inexpensive, it becomes easier bring these types of opportunities into the classroom".[6]

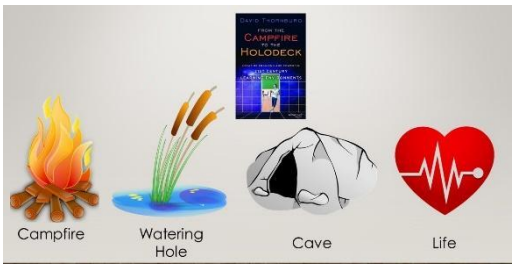


*Figure 1.2 - Oddone, K. (2016, May 18). Re-imagining learning spaces to inspire contemporary learning – part one: Models for change. Linking Learning. Retrieved January 24, 2022, from https://www.linkinglearning.com.au/re-imagining-learning-spaces-to-inspire-contemporary-learning-part-one-models-for-change/*

An effective school design will allow all four of these modalities to take place and work in unison. There is no singular style to use, but each complements the other and allows good cognitive growth for the student's understanding of the subject. When school children have developed a little bit of metacognitive language around their learning spaces, they can also take control of their learning and their learning spaces. This allows them to move to the room that best fits their education and explain precisely why this space will help them achieve their learning goals. This shift and allowance of children to have a voice allowing them to assist in a change that will influence their everyday lives. This allows underprivileged children a fair chance as their counterparts, enabling them to shape their future in ways never offered before.

## FIXING WHAT WE HAVE

The spark for school renovation usually results from failing school systems such as roofs, HVAC failure, or health and safety shortcomings. The objective of this section is to inform members of the community and other interested parties in school renovation of the benefits of this action. Several aspects will better the facility's productivity and have monumental impacts on the surrounding community. School renovation is not easy; the users, administration, and local government must work simultaneously. Issues such as existing amenities, funding, security, spatial usage, and the renovation's value dictate the action's process.

Essential factors such as funding, structural consideration, the role of the building in the community, and occupant safety; must all be considered when renovating a facility. The remainder of the section will discuss these factors individually and apply to all school districts across the nation.

1. Funding - The funding for the renovation will come from the school district and other Local Education Authorities.
2. Structural Consideration – Can the building's pre-existing condition and the system be improved?
3. Building Role in Community – What purpose outside of education will the building serve?

There are many financial, health, social, and environmental benefits from a school moderation. An incomplete school building will have more significant and expensive issues during its use the longer they are ignored. Most school districts have the option to defer maintenance or moderate their schools. These modernizations can't be ignored and those school who defer these options are doing their students a disservice.

### Environmental

School renovation is more sustainable than new construction, but some endeavors have surprising results. Having a school-supporting infrastructure already in place, less energy is expended. There is less need for obtaining and generating new materials. Not getting these materials and renovating the school's existing conditions reduces the amount of traffic. In turn, you reduce the number of greenhouse gasses released into the air. It is common knowledge that is the use of these harvested materials and transportation of them releases greenhouse gases, and renovating does not call for those unsustainable practices. A surprising 48 percent of the United States greenhouse gas emissions come from buildings' construction and everyday operation[1].

### Financial

Renovations are an opportunity to deliver more secure, modern, and engaging learning environments. The world is in a period of small budgets, and it makes sense to reserve money by renovating suitable existing structures. School renovations are usually drastically lower in price than building a new building from the ground up; lower costs correlate to site work needed and shorter turnover time for services. Prices may vary based on the project's scope, but renovations are not as costly.

Older schools located across America that were built in the early 20th century are excellent renovation contenders. This is due to the material used to construct them, their masonry construction, and the utilization of durable materials, like old-growth wood and authentic artistry/ embroideries. In addition to their inspiring architecture identities, these schools often include materials that would not be cost-effective for the school district in question to replicate, such as copper gutters, slate roofs, solid wood doors, marble finishes, terrazzo floors, etc. The last financial benefit of the rehabilitation of an existing school is that it typically uses almost 20% more labor than new construction. Additionally, the renovation labor is local, and the renovation's income stays in the local economy, creating a more robust economic stimulus within the area.

### Social

Finally, a small number of public institutions are more vital to developing a neighborhood than schools. For example, a pivotal part of the community has been removed when a local school is left unoccupied or scheduled for demolition. This has a significant impact on several community attributes such as property values, public and private investment in the community, and the culture of the residents. In addition, many of these schools are in underdeveloped schools.

## BENEFITS OF CHANGE

If there were different school paradigms in place, occurrences like school closures due to the COVID-19 crisis would not be an added threat that unsettles children's education and puts their psychological health at risk. Encouraging learning outside the classroom and utilizing teaching modalities allows flexibility in learning habits and fills in the gaps in e-learning by equipping the children to learn independently.

The ideology that schools are only for children of the community rather than the community is another example of an out-of-date ideology that we need to abandon. Creating schools that have incorporated academic, health, nutrition, and financial services will alter lives for all students and their families. Creating community schools with open networking paradigms will work with local businesses non-profit organizations, and partnerships proved paramount during the COVID-19 crisis as families faced unemployment, homelessness, and starvation. Even as a vaccine has become available, the economic effect of the pandemic have taken a longer-lasting toll on African American, Latino, and Native American communities. "School systems that were already struggling to support children and families have been strained more than ever by the public health and economic crises caused by the coronavirus pandemic. This legislation will invest in public schools and help them meet the needs of the whole child and the communities they serve," said Ohio Senator Sherrod Brown.[1]

## ENCOURAGING THE CHANGE

The most significant way to change the school system is to get more engaged. The school's faculty, community members, and parents have a right and obligation to advocate for their profession and quality services for students no matter the school district. Discovering who the principal choice makers in the school district are and the locations where the choices are made (e.g., building/site, district/central office, state level). An efficient advocacy campaign at the state level necessitates critical apparatuses comprised of support from the state association, a careful examination of factors affecting alteration in the state, a systematized plan of action for the condition, a director and committee of people eager to donate time and effort to the issue.

Most advocacy endeavors will not happen overnight. They require time, commitment, and tolerance. Local district-level initiatives can be productive within the first year, but most local and state-wide legislative and regulatory efforts need at least 2- to 3-year of continuous dedication. The dynamics of change happen slowly, especially within a challenging budget environment. Yet in still, a change could occur if the people involved are willing to maintain focus, verify priorities, and dedicate time and resources to the effort of improving our school systems.

## CONCLUSION

Education and architecture are closely associated with relationships, and as architecture continues to develop, it will transform the way designers analyze educational facilities. Architects globally are already moving away from the box-like brick-and-mortar lay that most grew up with. They have abandoned the one-room schoolhouse in the realm of history and have adjusted to match the present. As a result, modern school buildings do not need to look like the classical one-room schoolhouse from before.

Architects can have modern designs that incorporate open learning spaces, natural light sources, more communal spaces. All of which enhance student experiences and outcomes that promote their success. Many of these buildings do not look like schools, but who is to say what educational facilities should portray. A study from the U.S. Department of Education discovered that students in learning spaces with more natural light do 20 percent better in math and 26 percent better in reaching than those without natural sunlight. Small ideas like bringing in light can have big effects on children's cognitive

development. These should be made across the board, in all areas in all school districts. Fair chances at an early age allow proper socioeconomic growth and bridge the gap between different classes.
New school ideas are surfacing up all over the nation, and they do not look alike. These days attention is drawn to large windows, open floor plans, and unique designs, these facilities will keep students interested in learning throughout their school careers, fostering a natural curiosity that will carry past their everyday school life. Today's schools should no longer keep students separate from the rest of the world. Instead, they encourage them to engage in the world around them, from incorporating natural light to massive windows and open floor plans that move away from the more traditional rows of desks. Modern schools can help students succeed without dotting the landscape with bland, utilitarian block buildings like most of our readers attended. Let us move on from the classical/outdated systems in place and recreate a modern new "traditional standard."

## NOTES

[1] Rossi, Holly Lebowitz. “School Buildings Were in Trouble Even Before COVID-19,” September 23, 2020. https://www.teachforamerica.org/stories/school-buildings-were-in-trouble-even-before-covid-19.
[2] Gentzler, Doreen, and Patricia Fantis. “Study Saw ‘Striking Disparities' in DC Children's Coronavirus Cases,” August 6, 2020. https://www.nbcwashington.com/news/health/study-saw-striking-disparities-in-dc-childrens-coronavirus-cases/2384005/%3famp.
[3] Ikem, Okonkwo Vincent. “Explore Your Theory of Learning.” Medium. Initiate, September 3, 2016. https://medium.com/technology-learning/explore-your-theory-of-learning-765aa163ee14.
[4] Ibid.
[5] Oddone, Kay. “Re-Imagining Learning Spaces to Inspire Contemporary Learning – Part Two – Creating Your Space on a Budget.” Linking Learning, May 18, 2016. https://www.linkinglearning.com.au/re-imagining-learning-spaces-to-inspire-contemporary-learning-part-two-creating-your-space-on-a-budget/.
[6] Ibid.

## BIBLIOGRAPHY

Aikens, Nikki L., and Oscar Barbarin. “Socioeconomic Differences in Reading Trajectories: The Contribution of Family, Neighborhood, and School Contexts.” Journal of Educational Psychology 100, no. 2 (2008): 235–51. https://doi.org/10.1037/0022-0663.100.2.235.

Ali, Saba Rasheed, Ellen Hawley McWhirter, and Krista M. Chronister. “Self-Efficacy and Vocational Outcome Expectations for Adolescents of Lower Socioeconomic Status: A Pilot Study.” Journal of Career Assessment 13, no. 1 (2005): 40–58. https://doi.org/10.1177/1069072704270273.

Diemer, Matthew A., and Saba Rasheed Ali. “Integrating Social Class into Vocational Psychology.” Journal of Career Assessment 17, no. 3 (2009): 247–65. https://doi.org/10.1177/1069072708330462.

Garner, Andrew S., Jack P. Shonkoff, Benjamin S. Siegel, Mary I. Dobbins, Marian F. Earls, Andrew S. Garner, Laura McGuinn, John Pascoe, and David L. Wood. “Early Childhood Adversity, Toxic Stress, and the Role of the Pediatrician: Translating Developmental Science into Lifelong Health.” Pediatrics 129, no. 1 (2012). https://doi.org/10.1542/peds.2011-2662.

Gentzler, Doreen, and Patricia Fantis. “Study Saw ‘Striking Disparities' in DC Children's Coronavirus Cases,” August 6, 2020. https://www.nbcwashington.com/news/health/study-saw-striking-disparities-in-dc-childrens-coronavirus-cases/2384005/%3famp.

Ikem, Okonkwo Vincent. “Explore Your Theory of Learning.” Medium. Initiate, September 3, 2016. https://medium.com/technology-learning/explore-your-theory-of-learning-765aa163ee14.

McLaughlin, Katie A., and Margaret A. Sheridan. “Beyond Cumulative Risk.” Current Directions in Psychological Science 25, no. 4 (2016): 239–45. https://doi.org/10.1177/0963721416655883.

Oddone, Kay. “Re-Imagining Learning Spaces to Inspire Contemporary Learning – Part Two – Creating Your Space on a Budget.” Linking Learning, May 18, 2016. https://www.linkinglearning.com.au/re-imagining-learning-spaces-to-inspire-contemporary-learning-part-two-creating-your-space-on-a-budget/.

Reardon, Sean F., Rachel A. Valentino, Demetra Kalogrides, Kenneth A. Shores, and Erica H. Greenberg. “Patterns and Trends in Racial Academic Achievement Gaps among States.” Center for Education Policy Analysis, August 1, 2013. https://cepa.stanford.edu/content/patterns-and-trends-racial-academic-achievement-gaps-among-states-1999-2011.

Rossi, Holly Lebowitz. “School Buildings Were in Trouble Even Before COVID-19,” September 23, 2020. https://www.teachforamerica.org/stories/school-buildings-were-in-trouble-even-before-covid-19.

Stephens, Brent. Rep. *HVAC Filtration and the Wells-Riley Approach to Assessing Risks of Infectious Airborne Diseases*. Chicago , Illinois: Department of Civil, Architectural and Environmental Engineering Illinois Institute of Technology, 2012.

Thornburg, Devin G. “Coming out and the Challenge to Multicultural Education.” PsycEXTRA Dataset, 2007. https://doi.org/10.1037/e675432007-001.

Van Bergen, Elsje, Titia Van Zuijen, Dorothy Bishop, and Peter F. de Jong. “Why Are Home Literacy Environment and Children's Reading Skills Associated? What Parental Skills Reveal.” Reading Research Quarterly 52, no. 2 (2016): 147–60. https://doi.org/10.1002/rrq.160.

# EVALUATING THE SUSTAINABILITY OF HOUSING WITHIN INFORMAL TOWNSHIPS: A CASE STUDY OF MSHOLOZI INFORMAL TOWNSHIP LOCATED IN MBOMBELA – MPUMALANGA PROVINCE

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## INTRODUCTION

Housing seems to be the biggest challenge in South Africa, this is manifested in the rate at which informal settlements grow. In the African continent as of 2014 there is a total backlog of 50 562 000 houses and South Africa accounts for 2.3 million of this backlog [1]. Scholars such as Noah[2], are of the opinion that this housing challenge and need exist in South Africa because housing in the country is considered a basic human right. As a result, some South African citizens feel entitled to owning a free fully subsidized house. In most instances they take advantage of the law in an attempt to get the government's attention and quick delivery of housing by invading vacant land to build informal housing. As a result, informal settlements develop adding on to the housing backlog that is already high and making it hard for the government to eradicate it. In South Africa informal settlers are protected from evictions by means of law under the Prevention of illegal Eviction from and unlawful occupation (PIE) Act of 1998 and the Constitution of the Republic of South Africa 1996[3].

### Background

Msholozi is an informal township located in the Mpumalanga Province under Ehlanzeni District Municipality. It falls within the jurisdiction of the City of Mbombela (CoM) Municipality, it covers an area of 4.11 km² and consists of a population of 4 525 people and 1 816 households[4]. The township is accessed from the R40 road (see figure 1) and is well located in between White River town and Nelspruit/Mbombela (the capital city of the Mpumalanga Province). Msholozi was formed when people started invading open land (which was previously a farm) to build shacks in August 2009, some of the invaders were people who used to work in the farm and could not afford to buy their own stands[5]. In 2003, after a successful land reform restitution claim, the Department of Agriculture, Rural Development and Land Reform transferred 6 000 hectares of land worth R62 billion to Matsafeni Community Trust so that 1000 families could benefit[6]. The claimed land included land parcels in Msholozi and Matsafeni (where Mbombela stadium is based). The land was reclaimed from one of Mpumalanga's biggest farming company, namely: HL Hall & Sons. Msholozi Township is divided into six sections, there is a Phumlani Village, Hopeville and Msholozi A, B, C, and D.


*Figure 7. Map of Msholozi by HDA ArcGIS*

## HOUSING IN MBOMBELA

The CoM Municipality consists of formal households (as a dominating dwelling type), informal households and some unspecified type dwelling type. In 2016 an increase of 12.4% was noted in formal households which when converted to numbers makes 186 769 from only 166 136 formal households in 2011[7]. This followed after the municipality and the MPDHS made efforts to formalize some informal settlements. There was also an increase in informal households as of 2016 of 17 154 from 13 792 informal households in 2011 (refer to figure 2 below). People in the area tend to accommodate themselves on any vacant piece of land, even on top of mountains.

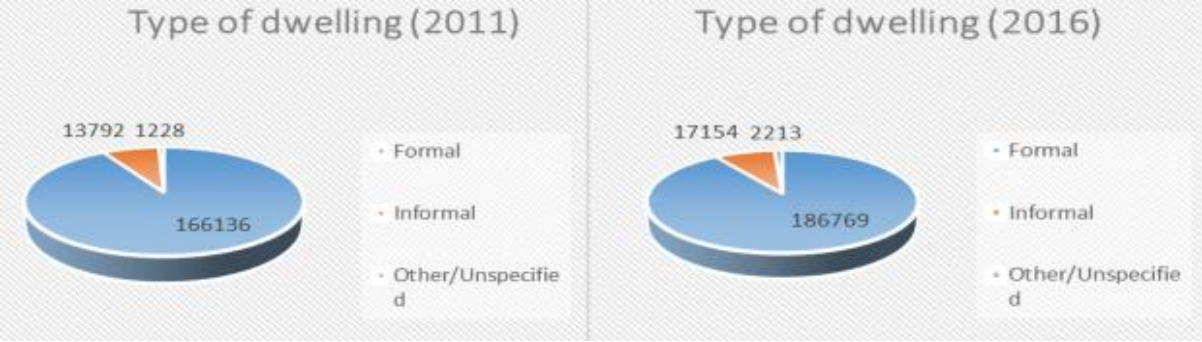


*Figure 8. Dwelling types in Mbombela by StatsSA (2011) and Community Survey (2016) cited in COM IDP (2017)*

According to the City of Mbombela [8] an estimated backlog of 32 554 units in the year 2017 was noted in the CoM. This backlog is said to be caused by rapid population growth as a result of migration, according to a CoM official. The migrants are largely from Nkomazi and Bushbuckridge local municipalities which are both neighbours of the CoM Municipality. Table 2 below shows the housing waiting list of the city per ward for 2017, which depicts the extent of the housing backlog. Msholozi falls under Ward 30 which includes White River, Phumlani Village and Rocky's Drift, the housing waiting list for Ward 30 in 2017 constituted of only 400 people.

| WARD 1 | WARD 2 | WARD 3 | WARD 4 | WARD 5 | WARD 6 | WARD 7 | WARD 8 | WARD 9 | WARD 10 | WARD 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| 550 | 1400 | 600 | 600 | 710 | 380 | 800 | 875 | 670 | 870 | 650 |
| **WARD 12** | **WARD 13** | **WARD 14** | **WARD 15** | **WARD 16** | **WARD 17** | **WARD 18** | **WARD 19** | **WARD 20** | **WARD 21** | **WARD 22** |
| 625 | 910 | 207 | 23 | 12 | 780 | 1705 | 1760 | 1900 | 780 | 1010 |
| **WARD 23** | **WARD 24** | **WARD 25** | **WARD 26** | **WARD 27** | **WARD 28** | **WARD 29** | **WARD 30** | **WARD 31** | **WARD 32** | **WARD 33** |
| 1150 | 1040 | 750 | 1350 | 1800 | 1080 | 765 | 400 | 400 | 575 | 2200 |
| **WARD 34** | **WARD 35** | **WARD 36** | **WARD 37** | **WARD 38** | **WARD 39** | **WARD 40** | **WARD 41** | **WARD 42** | **WARD 43** | **WARD 44** |
| 650 | 1100 | 650 | 475 | 310 | 710 | 745 | **2420** | **150** | **1680** | **1050** |
| **WARD 45** | | | | | | | | | | |
| **1380** | | | | | | | | | | |

*Figure 9. Housing waiting list per ward in Mbombela by COM IDP 2017*

## FACTORS INFLUENCING THE DEVELOPMENT OF INFORMAL TOWNSHIPS

Informal townships emerge as a result of frustrated citizens taking matters into their own hands to provide housing for themselves. With the case of Msholozi Township the residents did not just end by providing housing for themselves but saw an opportunity to provide for others and make an income out of it, revealed a CoM official. It was observed that there is a lot of dysfunctional low-cost housing prevalent in the township. Dysfunctional in the sense that landlords are more concerned with making profit and neglect their tenant's safety and living conditions as most of these accommodations are overcrowded. Some does not permit sunlight, some are built up to building lines which compromise tenants' privacy.

### Housing shortage

The residents of Msholozi claim to have bought the stands in which they have constructed their houses on. They revealed they opted to buy the stands illegally due to a lack of housing, as renting is expensive in towns (Nelspruit and White River). Residing in townships also requires a transport

budget and means spending many hours commuting to and from work whereas Msholozi is strategically located between their areas of work.

### Housing rights

The democratic government raised people's expectations when it broke down the news that people will have access to free, fully subsidized houses, in 1994 when it assumed power, as noted by Msholozi residents. Noah[9] echoes the same sentiments and adds that this created a sense of entitlement and dependency. Msholozi residents revealed that they settled on this land because they were tired of waiting on the government to provide houses for them, as some have been waiting since as far back as 1996.

### Lack of transparency

There seems to be a lack of transparency in terms of the way the government operates. The public has no access to information that can come to their aid. It's clear with the case of Msholozi that the residents have means to provide for their own housing, they only needed to be provided with stands by the government. When they were asked about the different subsidies available for their utilization such as Finance Linked Individual Subsidy Programme (FLISP) (which caters for the gap market earning between R 3 500 and R15 000) they had no knowledge of them. Others revealed that if they were updated about the progress of housing delivery maybe they would have waited for their turn and not lose hope on the government to provide for them.

### Lack of/minimal public engagement

The rate at which informal settlements grow shows a lack of public engagement in decision making and where it exists it seems to be minimal. This can also be blamed to a lack of capacity in government offices. Government officials only do public engagements as a way of covering their scope of work and for compliance purposes, they are not really interested in what the people have to say, and are said to be always in a rush to finish tasks, stated Msholozi residents.

### Slow rate of service delivery

Service delivery in South African townships seems to be happening at a very slow pace, this is depicted by frustrated residents who take to the street to protest for the delivery of services. The rate at which public or private open land is invaded for the development of informal settlements also show a slow rate of the delivery of housing by the government. As mentioned earlier some residents revealed that they waited for so long for government to provide housing free fully subsided for them.

### Illegal sale of land

It was observed that the houses built in Msholozi ranges from double-storey mansions, aesthetically appealing 3-5 bedroom houses and low-cost rental rooms. Majority of the residents claim to have bought their stands. Hence, the construction of houses using permanent and costly material.

### Corruption

Corruption is a challenge faced by most countries around the world and it prevents progress and development[10]. Theft of property and state funds seems to be a norm in government due to hierarchies, lack of accountability to subordinates by high-level officials who engage in shady tender deals with private firms. The residents of Msholozi blames slow housing delivery to corrupt government officials who steal funds and also to nepotism where officials prioritize their relatives over the needy.

### Lack of affordability and access to financial loans

Due to high unemployment rates and low wage rates in South Africa the low-income group (earning R0 – R3 500 per month) fail to provide shelter for themselves, and end up being reliant on the government for housing. As per Statistic South Africa's quarterly labour force survey, unemployment rate in the country rose to 34.4% in quarter 2 from 32.6% in the first quarter, adding half a million workers to the unemployed labour force which now makes a total of 7.8 million people[11]. Another common factor among informal dwellers is a lack of access to financial loans for housing development.

## CHALLENGES FACED IN INFORMAL TOWNSHIPS

Informal settlements or townships are bound to be faced with challenges as a result of developing on unauthorized land and without following appropriate town planning regulations.

### Fear of eviction

A key challenge faced by informal settlements/township dwellers is the fear of eviction as a result of settling on land they do not own. In August 2018 it was reported that 28 houses were demolished at Phumlani Village, among those houses was a mansion worth about R2 million leaving families homeless[12].

### Poor service and infrastructure delivery

At the time of invasion Msholozi did not have infrastructure such as piped water, electricity, sanitation, and a clinic, only one small primary school existed, stated Msholozi residents. The lack of services resulted to residents making means to provide for their own services by means of illegal electricity connections and illegal dumping of waste at bus stops (see figure 4). However, the CoM now provides services in the area such as waste removal on Thursday mornings only and water through communal taps on certain days of the week, revealed the residents of Msholozi but illegal dumping still continues. Also, in 2020 the CoM started connecting electricity in the area. Some of the streets in the area consists of clay and during rainy days' cars have to reroute because it becomes dangerous to drive on the streets.

*Figure 10. Poor Service and Infrastructure by Authors*

### Transport

The residents of Msholozi have been suffering from a lack of reliable and efficient transport system. The situation is now better when compared to the early years of the establishment of the township, noted the residents of Msholozi. The residents solely rely on minibus taxis and Buscor public buses that travel on strict timetables, favoring minority of the residents.

### Problematic township layout

In some parts of the township, a problematic layout has been formed. Some of the evern have double road access, others are not accessible at all by car as they are located in proximity to a wetland (see figure 5 below), on flood lines and buffers. Also, some of the houses built are not in line with building regulations and standards, as some lack ventilation and take 100% coverage of an erf.

*Figure 5. Inaccessible houses and a house built on a wetland by authors*

### Health implications of the challenges faced in Msholozi

Housing plays a crucial role in determining the health of its occupants and substandard housing is a major public health issue. In Msholozi Informal Townships challenges such as overcrowding (in some social housing), the location of houses on wetlands, lack of ventilation, houses that do not permit sunlight and illegal dumping of waste have health implications. Overcrowded housing is associated

with activations and transmission of tuberculosis, respiratory infections, and psychological distress[13]. When there is no ventilation the interior moisture of houses increases, and this excessive indoor temperature can cause mental health issues such as irritability and social intolerance. Houses located on wetlands normally become damp which makes them a nurturing environment for mites and roaches which contributes to respiratory disease pathogeneses. This also places residents at risk as it exposes them to floods, making them vulnerable. The fact that some of the houses in the township do not permit sunlight makes them cold and living in cold houses is associated with lower general health status and increased used of health services. Children may also get infected with diseases such as TB from playing near open waste dumped on the streets, and sites of improper waste disposal causes land pollution, and can harbor pests which can then infest homes.

## ASSESSING MSHOLOZI TOWNSHIP AGAINST INTEGRATED AND SUSTAINABLE HUMAN SETTLEMENTS INDICATORS

The concept of measuring the sustainability of informal settlements in cities has not been well explored in developing countries, notes Junita[14]. This concept rests upon three main pillars. Namely: social, economic and environmental pillar/dimension and the interaction of these pillars contributes to the development of healthy social environments. The table below indicates that Msholozi Township is sustainable.

| Dimension | Composite Indicators | Excellent/ High | Good/Moderate | Poor/Low |
|---|---|---|---|---|
| Economic Dimension | Employment | √ | | |
| | Income | | √ | |
| | Type of occupancy | | √ | |
| Environmental Dimension | Risk of natural disasters | √ | | |
| | Access to tap water and sanitation | | √ | |
| | Access to other public services | | √ | |
| | Air Quality | √ | | |
| | Vegetation | | | √ |
| | Pollution sources in the township | | | √ |
| Social Dimension | Education | | √ | |
| | Health | √ | | |
| | Safety | √ | | |
| | Sense of belonging | √ | | |
| Built-environment Dimension | Public facilities and spaces | | √ | |
| | Housing construction materials | | √ | |
| | Overcrowding | | √ | |
| | Land use | √ | | |

| | | | | |
|---|---|---|---|---|
| | Accessibility and mobility | | √ | |
| **Total** | | **7** | **9** | **2** |

*Table 3: Measuring the sustainability of Msholozi by Montoya et.al 2020 and authors*

Integrated and Sustainable Human Settlements indicators are different from sustainable development indicators, they range from an integrated street network to various dwelling typologies and others. The table below shows that Msholozi Township is not an Integrated and Sustainable Human Settlement. However, it has a potential to become one.

| **Indicators** | **Excellent** | **Good** | **Poor** |
|---|---|---|---|
| Integrated street network | | | √ |
| A range of dwelling types and tenure options | | | √ |
| Social facilities | | √ | |
| Various transport modes | | √ | |
| Economic amenities | | √ | |
| Public spaces and sites | | | √ |
| Green Infrastructure | | | √ |
| Consideration in design for safety and security | | | √ |
| Urban greening and agriculture | | | √ |
| **Total** | **0** | **3** | **6** |

*Table 2: An assessment of Msholozi against indicators of integrated and sustainable human settlements by author*

### Integrated street network

There is an opportunity for the CoM municipality to provide an integrated street network in the area with lanes dedicated for cycling. This is necessary to promote Non-Motorized Transport considering that White River is 8.1 km away from Msholozi where majority work and do their shopping.

### A range of dwelling types and tenure options

Once the area has been formalized there is an opportunity for different housing typologies to be

developed and for residents to have tenure options such as ownership or rental.

### Social facilities

Currently there is an existing primary school in the area. According to residents there is a secondary school that is being developed in the area and is almost completed. There is hope for other facilities to be developed once the area has been formalized, as it is stated by the City of Mbombela[15] that the area will be formalized and thereafter services and infrastructure will be provided.

### Transport modes

Two modes of public transport exist in the area: minibus taxis and Buscor bus service. Almost a quarter of the population in the area rely on private motor vehicles for transport. According to the City of Mbombela[16] a bus terminal/taxi rank is proposed to be established at Heidelberg Road/Wilkens Road intersection just outside of Msholozi which will also be enroute to Phumlani Village.

### Economic amenities

There are small businesses in the township ranging from manufacturing and sale of bricks, sale of wood for fire and for building purposes, driving schools, Spaza shops and hair salons, butcheries, guest houses, private health clinics and a pharmacy.

## MOTIVATION FOR FORMALIZATION OF MSHOLOZI INFORMAL TOWNSHIP

The integration and densification of cities has become a need in South Africa, as it is necessary for the creation of livable and sustainable human settlements. Since 1994 the objective of the government has been to redress the country's spatial structure so as to achieve spatial justice[17]. Therefore, urban sprawl should be avoided at all costs, infill development and compactness of cities should be promoted instead. Msholozi Township promotes compactness: unlike most informal settlements or housing, it is well located between two towns. It also falls along the Nelspruit – White River Development Corridor as it is located closer to the R40.

### Priority Human Settlements and Housing Development Areas (PHSHDAs)

Msholozi forms part of PHSHDAs. According to a CoM official PHSHDAs are zones earmarked for the development of human settlements and for investment by both the private sector and government. These zones are meant to advance the consolidation and spatial transformation of human settlements by ensuring that housing delivery revitalize and restructure cities and towns while fostering integrated urban forms, in order to overcome the spatial patterns of apartheid[18].

### CoM Spatial Development Framework (SDF)

Msholozi forms part of an area earmarked for future residential development within the CoM SDF, it is also located closer to Rocky Drift (a regional node) which is along the R40 road, and falls within the municipality's urban edge[19]. Rocky Drift takes third position in terms of employment areas. In first position there is Nelspruit followed by White River.

### National Development Plan (NDP) 2040

Msholozi Township is aligned to the vision of the NDP of creating settlements that are sustainable, liveable and that support economic opportunities[20]. It also promotes the concept of living, playing and working in the same space as it is strategically located between job opportunities.

## CONCLUSION

In conclusion, it has been articulated that South Africa suffers from housing shortage and that it currently has a housing backlog of 2.3 million housing units. As a result of the high backlog and other factors such as unemployment and lack of financial resources, informal settlements/townships develop as the only affordable accommodation to the low-income group. Residents of these informal townships are faced with a number of challenges such as those faced in Msholozi Township which includes fear of eviction, poor services and infrastructure delivery etc. The sustainability of the township in question (Msholozi) was measured using indicators of sustainability and proved to be sustainable but when assessed against the characteristics of integrated and sustainable human settlements it scored poorly. However, there is a possibility for the township to become an integrated and sustainable human settlement as it falls within the boundary of PHSHDAs. As a result, it was motivated that the township should be formalized, and missing services and infrastructure be provided.

## NOTES

[1] El-hadj M. Bah, Issa Faye and Zekebweliwai F.Geh. Housing Market Dynamics in Africa. (Macmillan Publishers Ltd), 2018. 6-7

[2] Noah K. Marutlulle, "Causes of Informal Settlements in Ekurhuleni Metropolitan Municipality: An Exploration," Africa's Public Service Delivery and Performance Review 5(2017):2-8.

[3] Kate Tissington, "A Resource Guide to Housing in South Africa 1994 – 2010" (SERI, 2011) 16.

[4] "Census" Statistics South Africa, accessed May 30, 2019. http://www.statssa.gov.za/?page_id=4286&id=11702

[5] Riet Hlatshwayo, "Premier Slams Land Invaders," Sowetan Live, June 14, 2020. https://www.sowetanlive.co.za/news/2009-08-17-premier-slams-land-invaders/

[6] Sizwesama Yende "Land Reform Gone Wrong: A Black Day Near White River," City Press, June 14, 2020. https://www.news24.com/citypress/News/land-reform-gone-wrong-a-black-day-near-white-river-20180806

[7] City of Mbombela Final Integrated Development Plan (IDP) 2017 – 2022. City of Mbombela Municipality, accessed September 20, 2020. https://www.mbombela.gov.za/final%20idp%20for%202017-2022.pdf 102, 164-165.

[8] City of Mbombela Final Integrated Development Plan (IDP). Ibid. 102

[9] Noah K. Marutlulle, "Causes of Informal Settlements in Ekurhuleni Metropolitan Municipality. Ibid. 2-8

[10] Tatenda Manomano, Pius Tangwe Tanga and Perpetuu Tanyi, "Housing Problems and Programs in South Africa: A Literature Review." Journal of Sociology and Social Anthropology 7(2016): 113

[11] Sara Smith, "Unemployment Rate Hits Record High Again," Mail & Guardian, November 19, 2021. https://mg.co.za/business/2021-08-24-unemployment-rate-hits-record-high-again/

[12] "Houses Demolished, Leaving Msholozi residents Homeless" SABC News, June 09, 2020. https://www.youtube.com/watch?v=5VVOtI5iM0E

[13] James Krieger, MD, MPH and Donna L. Higgins, "Housing and Health: Time Again for Public Health Action". Public Health Matters. 92(2002): 758.

[14] Juanita Montoya, Ivan Carters and Antonio Zumelzu, "Indicators for Evaluating Sustainability in Bogota's Informal Settlements: Definition and Validation." Sustainable Cities and Societies 53(2020):3-4

[15] "City of Mbombela Spatial Development Framework (SDF) Review 2018 Working Document" City of Mbombela Municipality, accessed September 20, 2020. www.mbombela.gov.za/draft%20sdf%20document.pdf 79,168

[16] City of Mbombela, *SDF*, 2018.

[17] ´National Development Plan 2030: Our Future – Make it Work "National Planning Commission, accessed December 02, 2020, www.gov.za/documents/national-development-plan-2030-our-future-make-it-work 259.

[18] "The Housing Act: Declaration of the Priority Human Settlements and Housing Development Areas (PHSHDAs)" Department of Human Settlements, accessed August 08, 2020. https://www.gov.za/sites/default/files/gcis_document/202005/43316gon526.pdf 18.

[19] City of Mbombela, *SDF*, 2018.

[20] National Planning Commission, *National Development Plan*, 2011.

## BIBLIOGRAPHY

Ackerman, C. "Evaluating Integrated Human Settlements by means of Sustainability Indicators". Potchefstroom Campus: North-West University, 2016.

Bah, El-hadj M; Issa, Faye and F.Geh Zekebweliwai. Housing Market Dynamics in Africa. (Macmillan Publishers Ltd), 2018

Charlton, Sarah. "State Ambitions and Peoples' Practices: An Exploration of RDP housing in Johannesburg. University of Sheffield, 2013.

City of Mbombela Final Integrated Development Plan (IDP) 2017 – 2022. City of Mbombela Municipality

Krieger, James MD, MPH and Higgins, Donna L. "Housing and Health: Time Again for Public Health Action". Public Health Matters. 92(2002

Lehohla, Pali. "The State of Basic Service Delivery in South Africa: In-depth Analysis of the Community Survey 2016 Data". Statistics South Africa, 2016.

Manomano, Tatenda et al. “Housing Problems and Programs in South Africa: A Literature Review.” Journal of Sociology and Social Anthropology 7(2016)

McGarry, Michelle, S. “From Housing to Human Settlements: The Role of Public Space in Integrated Housing Developments”. Cape Town: University, 2017.

Mlangeni Thobile “Msholozi to be a Township”. Mpumalanga News, June 14, 2020. https://mpumalanganews.co.za/178710/msholozi-township/

Noah K. Marutlulle, “Causes of Informal Settlements in Ekurhuleni Metropolitan Municipality: An Exploration,” Africa’s Public Service Delivery and Performance Review 5(2017

Obioha, Emeka, E. “Addressing Homelessness through Public Works Programmes in South Africa”. South Africa: Walter Sisulu University, 2019.

Rai, Pallasi, T. “Townships for Sustainable Cities” Procedia Social and Behavioral Sciences 37(2012):417-426.

Rerat Patrick. “Housing, Compact City and Sustainable Development: Some Insights from Recent Urban Trends in Switzerland” Switzerland: University of Neuchatel.

Tagg Jason, H, “Providing Adequate Housing in South Africa in the Twentieth and Twenty First Century,” Pretoria: University of Pretoria, 2012.

Turok, Ivan. “The Three Pillars of Sustainable Human Settlements”. Cape Town: Human Sciences Research Council, 2011.

# URBAN LIGHTHOUSES AND A TACTILE CITY - BRISTOL

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## INTRODUCTION

Bristol is promoted as a vibrantly connected and social city, but it is also busy, noisy, dense and complex. Radiating from the centre is a network of roads, one-way systems, rivers and bridges, pedestrian areas and cycle paths. Bristol was heavily targeted by the Luftwaffe in the second world war, demolishing the medieval heart of the city, and since then its infrastructure has been subject to many revisions and reconstructions. Roads and paths are constantly repaired or rebuilt and public transport is regularly redirected. For any visitor, therefore, Bristol city may be considered as too difficult to navigate and perceived as unwelcoming and overwhelming. The aim of this chapter is to use Bristol as a case study to understand the complexity of the city from a social perspective to understand how people access and navigate our city. For the purpose of this research we have concentrated on a sector of the community, the visually impaired, who find it very hard to access places and information that are taken for granted by sighted people. As part of this case study Bristol Legible City has collaborated with and described a number of projects that are underway. The underpinning question **considers:** how can cities become more inclusive and welcoming for everyone?

## CASE STUDY OF BRISTOL

With a population of around 463,400, Bristol is the largest city in the South West of England.[1] It is situated at the corner of the M4 and M5 motorway corridor, is a central rail hub for the Great Western Railway, and the Severn Bridge provides a major link to Wales. Bristol is both a city and a county, and borders with Gloucestershire and Somerset, the west coast, Avonmouth and the River Severn. The Rivers Frome and Avon feed into the River Severn's estuary which in 1809, established Bristol as an innovative port city. The civil engineer William Jessop with his floating harbour, enabled ships to sail into the heart of the city. The location made it ideal for early voyages to undiscovered lands, including the first European to land in North America, John Cabot. Bristol's rich history started with settlements dating back to the Iron Age and gained momentum from the woollen trade in the Middle Ages; in the early 1900s regional specialism in aviation began, focusing on aerospace in the 1970s and in the high-tech industries in micro-electronics in the 1980s. More recently, television and film industries thrived, including the BBC, Aardman Animations and Bottle Yard Film Studios.

Popular tourist destinations include the Bristol Zoological Gardens - the oldest provincial zoo; Clifton Suspension Bridge (Figure 1) and the SS Great Britain - both of which were designed by Isambard Kingdom Brunel (1806-1859).[2] Cultural places include the Arnolfini Gallery (Figure 1), Watershed

and Pervasive Media Studios, and Spike Island artists' studios, all of which contribute to the arts, cultural and social sector of the city.[3] It is now a city that is an essential hub for creative clusters, networks and resilient cultural ecologies.[4]

The research is part of a larger body of work that seeks to understand how the city of Bristol responds to the demands of different cultural, socio and economic groups. Our past research has sought to understand how design adds value to a city,[5] exploring issues of resilience and sustainability and the impact of re-distributed manufacturing (RDM) at the scale of the city and the regions.[6] Bristol was named as one of the first 100 resilient cities.[7] Our research has studied these issues from several disciplinary perspectives, bringing together experts in manufacturing, design, logistics, operations management, infrastructure, resilience, sustainability, engineering systems, geographical sciences, mathematical modelling and beyond. We have used a combination of co-design and action research as part of our research methodologies. Action Research has been used to address the qualitative aspects of the project. This has included, site visits to museums and public spaces, collecting material information, visitor surveys, working with different user groups to gain feedback, workshops material exploration and feedback of maps and interfaces. Using a circular approach, feedback has been used to inform how we co-design with different stakeholders, namely in this instance with the visually impaired to build products and services. The following examples are ideas and methods that could be modified for different environments including, open spaces, museums and historic houses.

## BRISTOL LEGIBLE CITY

Bristol Legible City is a unique concept to improve people's understanding and experience of the city through the implementation of projects exploring identity, information and transportation. Bristol Legible City began in the 1990s, prompted by large scale regeneration within the city's central area. An opportunity enabled by this investment was to directly address some of the historical barriers presented by the city to address navigation. Bristol has a complex history and built form that is defined by successive periods of significant change. The city's legacy of nineteenth-century engineering, war-time bombing, and post-war road infrastructure has resulted in Bristol being a somewhat fragmented city with more than one centre, bisected by two watercourses, and featuring large fractures in the urban fabric resulting from large-scale road building during the 1960s and 1970s. All these factors created significant barriers to movement across the wider city area and creating a sometimes illegible and disorientating environment. As with several other UK cities in the 1990s, development in Bristol was subject to a renewed emphasis on city centre living, growing the leisure economy, and providing a high-quality public realm.

Bristol Legible City was instrumental in delivering this vision with a programme of public realm enhancement projects, a series of public art commissions, and the development and delivery of a coherent and consistent wayfinding and city information system. It is this last element of the project that most people encounter when travelling about Bristol. The project is designed to be intuitive, to be used by visitors and residents, and is resolutely user-centred in its development, and innovative in its information design and presentation. This design innovation has since been adopted by cities both across the UK and internationally. The most obvious manifestation of the project is the on-street pedestrian wayfinding system, which can be found throughout Bristol's central area. Extensive development work in information design, cartography and graphic representation was undertaken to ensure an accessible, connected and intuitive wayfinding system was provided. Much of this work was founded in, and directed by, a detailed exploration of how users apprehend, retain and make use of rich spatial information to negotiate the complexity of the built city.

In recent decades, Bristol has seen a huge investment in the physical regeneration of its central and eastern districts. The regeneration is mainly concentrated on the harbour side, where large disused

containers have been available for new activities. Another important area of development comes from the transformations initiated by the construction of the M4 motorway to the east of the city.
Bristol's population is growing rapidly, as are the numbers of people visiting the city. There is a growing emphasis on providing a welcoming, sociable, high-quality public realm, that is more sustainable, with walkable neighbourhoods, and a desire for a city that works better for all residents. Critically this vision for the city has a strong basis in local, city policy with a drive to provide a fairer, fully inclusive city that recognises and responds to the needs of all of its residents and visitors: resolving the city to be more welcoming and accessible.

## BRISTOL TACTILE PROJECTS

Wayfinding strategies for the visually impaired are fundamental for providing social inclusion, a better quality of life, a level of independence and urban accessibility for people with special needs. Recent digital technologies can provide significant benefits, such as GPS localisation and text-to-speech, for example for the visually impaired, by improving their interaction and navigation on unfamiliar routes. During the summer of 2019, we undertook a series of activities to understand accessibility issues and barriers to Bristol city and its museums. Our first exercise involved preliminary desk-research contacting museums about provision for the visually impaired. We asked a series of questions: if there was any accessible information present upon arrival and location; whether there were other accessible formats to assist people with visual impairments, whether the ground was level or placement of wayfinding signs or lighting. Responses ranged from, special guided tours on certain days, audio guides and optical ID pens, and 'nothing to offer at the moment'.
The second exercise involved a researcher, who was visually sighted, to visit many of the popular museums, test the veracity of the information, the availability of any guides, and photograph the journey around the exhibition. Although Bristol is an old city, significant provision was made for wheelchair users, including accessible entry points and uniform floor surfaces. Some museums provided interactive exhibits that were specially designed for children. Many information boards were well designed but were not multi-functional. One museum did have optical ID pens, but unfortunately, these were not working (due to no batteries). A third exercise involved short to long walks between arrival and destination points, for example, Bristol Bus Station or Bristol Temple Meads to the Eye Hospital or Bristol Royal Infirmary. The researcher recorded these walks, who is visually sighted, and took photographs and notes along the journey. A typical 1-minute walk from the Bus Station to the Eye Hospital included several obstacles and trip hazards.

## BRISTOL MAPPING AND A TACTILE CITY

In consultation with RNIB, Bristol Legible City and CFPR (Centre for Fine Print Research) [8] addressed several core themes of the government's Industrial Strategy Green Paper.[9] In doing so the focus was on sectoral needs in the health, tourism and heritage industries with an enquiry into the uses of digital technologies.
The project scoped and researched appropriate methods of tactile map-making and maps for the visually impaired that could improve their navigation around the city of Bristol. As part of this project, we sought to understand what a city feels like, that without the aid of sight, what different perceptions could be used to translate these sensations?

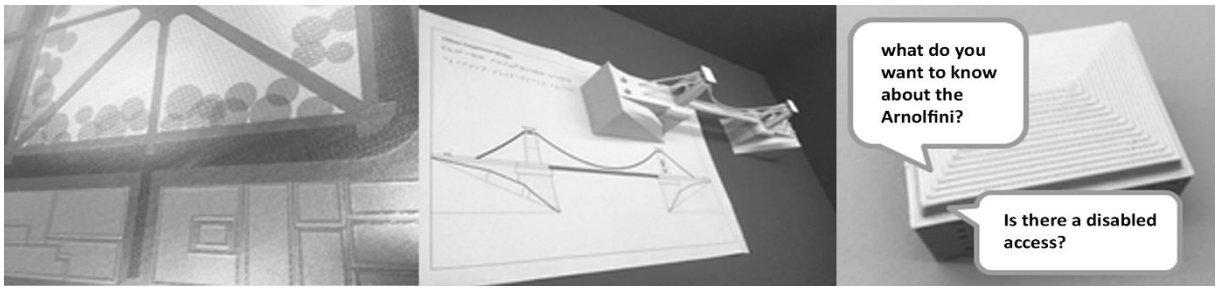


*Figure 11 (left) Tactile map of Queens Square, (middle) printed replica of Clifton Suspension Bridge with embedded sensors, (right) interactive prototype of the Arnolfini Gallery (CFPR)*

We used computer-based modelling and CNC rapid prototyping technology to develop methods that incorporated 3D printing and embedded RFID technology, linking 3D printed objects and tactile paper maps to the city's street signposts and cultural information. It explored different materials, 3D and relief printing (fig. 2), and casting methods that could convey different sensations. It explored creating a tactile taxonomy for map prototypes that could be cheaply produced using recycled paper, but robust enough to incorporate Braille dots and raised textured symbols. This project has sought to collect tangible and tactile resources that can assist visually impaired people in navigating and recalling information about complex city environments, in particular, large public spaces and city cultural institutions and that could improve their navigation around the city of Bristol.

## BRISTOL SENSORY MAPPING

Building on this existing work, a brief was set by Bristol Legible City and CFPR for designers and artist's Studio Meineck and Splash & Ripple to explore the development of low-cost tactile mapping resources for users with a visual impairment to navigate the city and access cultural destinations. This collaborative research between Studio Meineck, Splash & Ripple, PECo Theatre, Bristol City Council, CFPR, and a cohort of visually impaired people (VIP) explored sensory mapping for VIP and their relationship to the City of Bristol, memory and storytelling. Through the sensory mapping project, designer Chloe Meineck and a visually impaired companion entered into a discursive walk around the city and talking about their journey whilst Meineck highlighted the no-go areas and obstacles. They then worked together, recalling the journey and mapping emotions and sensory delights. By embedding their stories as a physical and textural walk on their map, they could retake the journey with their fingertips; as part of the mapping process, Meineck combined swell-paper, and different textural materials and conductive ink.

*Figure 12 Tactile maps and waymarking for recalling memories and storytelling – photo courtesy of Chloe Meineck.*

Walking tours of the local area during which three to five discussions took place – informal interviews which were recorded as audio files. The content of these discussions was varied but related directly to the interviewee's experience of being in, and navigating the city; their lived experience of moving about the city as a person with a visual impairment. Technical challenges, personal observations, emotional responses, using sensory cues – sound, which parts of the city were considered welcoming and those that were not. Working with this interview material Chloe Meineck developed an early prototype of a touch-activated map of a user-journey constructed using low-cost materials and technology - thermal paper, conductive paint, textural differentiation, audio storage, processing, and playback.

## TECHNICAL REVIEW

The following review highlights a range of technologies available, concerning their pros and cons and possible applications. From a wide survey, the available technology can be categorised as virtual (not related to the on-site experience, mediated through digital means), screen-based technology (mainly related to smart phones with aids for the visually impaired), tactile and analogue (standard media such as tactile maps, with no digital features), and relatively little that addresses the gap. These different aids use different senses (touch, hearing), often combined, and different infrastructures (physical and digital). The systems hold advantages for navigation both in research before visiting an area and the exploration upon arrival.

### Preliminary navigation

Some aids could be applied in map-based exploration, usually before visiting an area. These aids can be used to plan a visit therefore building confidence of the area while on-site. Handheld tactile maps provide descriptive and spatial indications, allowing cognitive mapping of the area.[10] These maps make use of raised shapes, lines and Braille to convey information, while often blocks of colour are used along with the shapes for visual cues. Tactile maps are made from a range of materials, such as paper or 3D prints, and these maps are available as single sheets or in booklet formats making them portable and even suitable to send in the post. [11] [12]

Another solution are the Optical ID pens, that can detect recorded information from a unique printed microdot. A printed support stores the data, and when the pen cross-references this ID code with stored audio data, the information can be recorded and replayed, or over-written.[13] It is useful for a range of applications including object identification, such as labelling the name of a product (food item, hazardous substance), or a longer contextual description (museum display, points-of-interest on paper maps).[14] The system provides almost pin-point accuracy, are cheap and allow for the placement of different 'tags' in close proximity.[15] Despite the benefits however, our testing of these products shows that they are less effective under poor lighting and can be easily worn away or delaminate and the user needs to apply the pen almost directly onto the tag for its operation.

Among the various possible options, Conductive materials have been tested, such as paint, ink or cotton thread which can be triggered by a touch that activates an event, for example switching on a light or making sounds. These materials can be used in conjunction with tactile maps and connected to a computing device which handles the touch-trigger and plays the associated sound.[16] The materials can operate in any light, is cheap to produce and fun as a learning tool, but can become easily worn away, and when broken or cracked then the circuit is compromised.[17]

### Real-time navigation

Other aids are useful for real-time navigation. These aids vary vastly in design and ability to address the needs of visually impaired people. On-site tactile maps are usually made from robust, long-lasting, materials with matt finishes to avoid wear and displaying fingerprints. These kind of maps are designed to be read by anyone, including those with visual impairments and used both indoors and outdoors. [18] These large maps have similar benefits to their hand-held counterparts with the addition of their enlarged size increasing readability. Maps are installed at fixed points, so any person using them must remember its information to aid them until they reach another map.

Tactile pavements are present in the major pedestrian routes and used to convey important navigational data such as directions or hazard warnings.[19] These textured surfaces can be detected underfoot or via navigational (white) canes. However, up to 58% of this pavement is installed incorrectly and may pose as a trip hazard.[20]

Physical audio aids such as pelican or puffin traffic light-controlled crossings or talking elevators, provide clear indications of the direction and when to act.[21] Implementation is sparse due to the lack of legal requirement, for example, where two sets of traffic lights are set in proximity, conflicting noises may lead to confusion.[22]

QR codes affixed to points-of-interests (POI) provide information or redirect users to webpages containing further details are used for product searches and navigation. [23] Webpages can provide navigation details or information about the POI. QR Codes have been used as on-floor signage for smart devices to receive real-time location data. [24] However, navigation in open spaces requires covering the floor with numerous codes, for people to follow a predefined path. QR codes require a clear line-of-sight which becomes a problem in busy areas such as bus stations, where people may obscure the code. [25]

Near Field Communication (NFC) is a passive wireless communication protocol, that uses radio waves within a 13.56 MHz frequency band, that is accurate to a range of 4cm. Tags store machine-readable data and powered by the reading device, helping to keep them sticker-sized. [26] Tags are cheap to produce, do not need a direct line-of-sight so can be embedded inside objects, and detected by an NFC enabled reader such as a smartphone.[27] However, tags cannot differentiate between multiple readers within range and their signal strength can be affected by external elements such as nearby metals. [28]

Li-Fi (light fidelity) uses optical, rather than radio, frequency and used in devices such as remote-control units. To provide directions, units sending current positional information are installed at key navigation points, such as junctions, and receiver units are carried by the explorer. Light-emitting diodes (LEDs) have high intensities and therefore can achieve very large data rates. Li-Fi is not affected by radio frequency interference but requires a clean line of sight, therefore cannot work if obstructed by people or in bright sunlight. [29 30]

GPS navigation systems triangulate the user based on the relative position of satellites, and the system's logic overlays the position onto a mapping software. [31] GPS is commonly found in smartphones and globally available. However, GPS is more accurate outdoors and within the line-of-sight of at least four satellites, without interference from buildings or poor weather.[32]

Bluetooth (iBeacon) Tracking and Navigation is a proximity-based technology (rather than location information). The user carries a device such as a smartphone with a beacon-associated-app that relays information based on the identified Beacon. [33] The Beacons are easy to install and can be retrofitted to existing exhibits, or placed around a space to aide navigation and can localize the user more accurately than with GPS. A network of Beacons is required to prompt navigational systems and require a power source, commonly batteries, and maintenance.

Camera Tracking, as it suggests, is a device that registers and tracks the movement of the user's finger or hand over the 'hot spots' of an object. Other uses include detection of the body's proximity, providing different ambient sounds depending on how close the user is to the camera, for example. [34] This technology can be used to gather data as well as provide data. Two types of methods involve a depth camera that characterises movement based on contours of an object or surface, or an RGB camera that detects colour markers usually placed on the fingernails. [35] This method can be used for retrofitting to existing objects, works across any surface, and is very accurate. A range of hardware can be used, such as a fixed overhead camera or smartphone. However, the smartphone would need to be held by the user and this may be less effective. [36] It is also less effective for large objects or if the whole object is not wholly in the field of view of the camera.

## URBAN LIGHTHOUSES

The project uses the existing infrastructure of the wayfinding signage system (these are referred to as monoliths in the rest of the document). The monolith was provided by Bristol Legible City and is enhanced with embedded technologies and data, specifically designed for the visually impaired. Analogous to the lighthouses that guide sailors across unfamiliar water, the system provides useful and relevant information to users with a visual impairment, wanting to explore the city. The project aims to upgrade, extend, and expand the reach of standard infrastructures (public signage, bus stops, traffic lights), to an audience with special needs, by the use of digital means. The pilot project provides a focus for experimentation on accessibility, with the purpose of scalability for different networks and smart cities. The pedestrian wayfinding monoliths are being upgraded with a richer level of mapping repurposed with new technologies. The other purpose for the city council is to provide environmental data, that will be open and available for use by the community. For this reason, monoliths are powered and connected to the Internet. In addition to this, monoliths interact with users by different means: medium-range localization (Beacons), and short-range interaction (touch-based sensors).

The range of adopted technologies goes from GPS, a long-range one way only (from satellite to the user) communication system to Bluetooth, a medium range (up to fifteen meters) bidirectional system, to touch, a short-range (arm reach) interactive system.

The system uses different available digital technologies to provide indications both indoors and outdoors, with different degrees of accuracy. It also allows a bi-directional (anonymous) interaction between the user and physical objects, which is normally not possible with technologies such as GPS. The project is under development with the collaboration of Toshiba (UK).

## THE PILOT PROJECT

The indications for the design of more accessible buildings and cities differ worldwide and apply mostly to the functional part of navigation rather than to the descriptive part. Tactile paving, tactile maps, audio warnings signals (for example at traffic lights), are just some of the aids for the visually impaired.[37] These infrastructures require substantial economic investment and are therefore generally limited. In addition to these physical infrastructures, there are important steps forward towards the accessibility of the visually impaired by widespread technologies (see technical review).[38] Most physical infrastructures work on a tactile basis, while digital infrastructures prefer the audio component. It is important to note that although smartphone screens are called touch, the haptic portion is close to zero, being them flat. A quick analysis of the systems currently in use shows that no solution is exhaustive and that there is currently no interaction between the various systems except in a limited way (e.g. button/traffic light / tactile pavement) and within the same category. Moving from A to B in an unfamiliar path implies strategies for the visually impaired of different kinds that lead to

different results, as indicated in the study Analysis of wayfinding strategies of blind people using tactile maps. [39]

The best results happen when with the aid of tactile maps, it is possible to build a mental map of space, and this is normally not possible with the only help of smartphones. As mentioned, the project aims to use the different infrastructures at the same time to facilitate urban navigation for blind people. Furthermore, it aims to overcome the only functional indication of the route from A to B (wayfinding) but proposes a narrative description of the city. The synergy between physical and digital infrastructure is optimal to enhance the awareness of space thanks to mental maps. The system uses GPS and widespread navigation systems such as google maps, to move from different points in the city called hotspots. Hotspots are points of interest, equipped with a technological infrastructure (beacon and touch) and specific content for the blind (audio descriptions and touch panels, enhanced with Braille tags). Once in the proximity of the hotspot, the app switches to Bluetooth mode and receives specific information about the location, both indoors and outdoors. When in Bluetooth mode, it is possible to interact, for example, by requesting that an object (the monolith) responds with a call-back sound from a phone, enabling immediate localisation. In the following illustration, we can follow how a visually impaired person can start to navigate an unfamiliar city from the exit point of an airport or railway station, arriving confidently at their destination.


*Figure 13 Schematic diagram of the system*

A visually impaired person in an unfamiliar environment has many distractions and cannot always obtain and locate dedicated aids. Beacon communication can transmit directly to the personal device, within a radius of about 15 metres. It is possible to connect device and aid (via Bluetooth communication) and to provide sound signals, which are particularly effective for localization, instead of using triangulation systems that are difficult to implement (beacon networks). When the device is shaken, the aid emits a sound, which is useful for localization. Once in close proximity of the aid (designed for everyone, and not only for the visually impaired), the visitor can touch it to receive relevant information and can provide spatial indications for mind maps (indicating real distances, oriented and comprehensible). The system will then provide necessary route indications using standard GPS platforms. En route, it is also possible to receive descriptive information, and not only functional information (turn right or similar). A network already available in the city, as demonstrated by Bristol Legible City, can provide a structured orientation system for people with visual impairments.

## DEVELOPMENT OF THE PROTOTYPE

The prototype has been developed using low cost and open-source electronic boards, to ensure the project easily scalable and exportable in other cities. The main requirement is to allow Bluetooth communication between a portable device (Android operating system during the prototyping phase) and the monolith. The board that has been used in the prototype is called Arduino101[40] which has the main characteristics of a standard Arduino board, plus the built-in Bluetooth connectivity. In addition

to this board, a second board called Bare Touch adds an array of capacitive sensors, useful for the haptic part. The two boards are interconnected through serial communication. When the mainboard (Arduino 101) is powered, it starts broadcasting a signal which contains the following information:
Under the protocol called BLE (Bluetooth Low Energy), the broadcast of this simple information is repeated continuously. When a personal device, with a special app running in the background receives the signal (normally if within the range of 15 metres) sent by the prototyping board, it sends a request to establish bidirectional and exclusive communication. When the connection is active, the user can interact with the monolith within the Bluetooth reach. When the user shakes his phone, a signal is sent to the monolith, and a sound alarm is triggered. This is an effective way to easily locate the monolith, as it is proven by other devices for the blind (i.e. traffic lights or elevators).
On the software side, a widely used open-source system is the MIT App Inventor.[41] This platform, available on-line, allows any user, even with no coding skills, to develop applications for digital devices such as smartphones and tablets. This solution has the advantage to use a visual programming approach, making it more accessible even for people with no background in coding. This solution, on the software side of the project, was combined with another open source resource on the hardware side, which is widely documented and low cost: Arduino. Arduino is an ecosystem composed of hardware components, software development and support communities. The software component of the app was therefore developed with App Inventor, while the electronic part with Arduino, both of which are low cost, accessible, open source and widely used platform.

## CONCLUSION

A growing cohort of project partners is developing further work to test and evolve the creative potential of tactile interfaces and intelligent user-centred design for city navigation systems. In addition to upgrading Bristol's wayfinding street furniture and digital cartography to allow direct interaction and manipulation of environmental data and route information, project partners will be working directly with users to design a more responsive and user-centred methodology to grow city navigation and information system that responds directly to user-needs and provides an iterative and collaborative approach to providing city spaces and services that place accessibility and equity at their centre. Work continues with Toshiba and UWE's Department of Computer Science and Creative Technologies, to roll out the upgrade of the map units across the city, and also in collaboration with interaction designer Chloe Meineck to test and refine the user experience. The next phase of the project is an extensive testing activity, with a focus group of blind people, and is currently on hold due to the restriction of COVID-19.
The pandemic has also shown how a crisis condition can be even more serious for those who already have disabilities or frailties. Responses tend to be worked out for most people and sometimes minority communities do not fit within the parameters of emergency solutions. For example, safety distance is difficult to assess in the case of low vision, refraining from touching surfaces can be very difficult, and loss of sense of smell and taste has very serious consequences because they already suffer from deprivation of other senses. These limitations can lead to a reduction in outdoor activities and lead people with visual impairments to greater isolation.
For this reason, projects that use technology to facilitate urban navigation can be of great importance in ordinary and even extraordinary conditions, such as a pandemic.

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## NOTES

[1] Bristol City Council. 2020. 'The Population of Bristol - Bristol.Gov.Uk'. September 2020. https://www.bristol.gov.uk/statistics-census-information/the-population-of-bristol.
[2] TripAdvisor. 'THE 10 BEST Things to Do in Bristol - 2022 (with Photos)'. TripAdvisor. Accessed 18 January 2021. https://www.tripadvisor.co.uk/Attractions-g186220-Activities-Bristol_England.html.
[3] 'Bristol Museums & Galleries - VisitBristol.Co.Uk'. n.d. Visit Bristol. Accessed 18 January 2021. https://visitbristol.co.uk/things-to-do/museums-and-galleries.
[4] Dovey, John, Andy C Pratt, Simon Moreton, Tarek Virani, Janet Merkel, and Jo Lansdowne. 'Creative Hubs: Understanding the New Economy', 2016. https://creativeconomy.britishcouncil.org/media/uploads/files/HubsReport.pdf.
[5] Parraman, Carinna, Hughes Ellen, Glenn Parry, Don Webber, Jon Dovey, Kayla Rose, Chris McMahon, et al. 'Bristol and Bath by Design; To Understand the Economic and Cultural Value of Design in the Bristol and Bath Region', 2016.
6 EPSRC. 'Re-Distributed Manufacturing and the Resilient, Sustainable City (ReDReSC)'. Engineering and Physical Sciences Research Council, Polaris House, North Star Avenue, Swindon, SN2 1ET, 31 March 2015. https://gow.epsrc.ukri.org/NGBOViewGrant.aspx?GrantRef=EP/M01777X/1.
[7] Evans, Joe. 'Future-Proofing Cities: Bristol Starts Planning for a More Resilient Character'. The Guardian, 6 March 2014, sec. Cities. https://www.theguardian.com/cities/2014/mar/06/bristol-unveils-plan-resilience-longevity.
[8] AHRC. 'Creative Economy Engagement Fellow: Digital Tactile Mapping Funded by AHRC National Productivity Investment Fund', 1 January 2018. https://gtr.ukri.org/projects?ref=AH%2FR013365%2F1.
[9] HM Government. 'Building Our Industrial Strategy', January 2017. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/611705/building-our-industrial-strategy-green-paper.pdf.
[10] Papadopoulos, Konstantinos, Marialena Barouti, and Eleni Koustriava. 'Differences in Spatial Knowledge of Individuals With Blindness When Using Audiotactile Maps, Using Tactile Maps, and Walking'. Exceptional Children 84, no. 3 1 April 2018: 330–43. https://doi.org/10.1177/0014402918764300.
[11] 'Tactile Images and Maps'. RNIB, 2015, https://www.rnib.org.uk/sites/default/files/tactile_images_and_maps_2015_brochure_low_res.pdf.
[12] Albouys-Perrois, Jérémy, Jérémy Laviole, Carine Briant, and Anke Brock. 2018. 'Towards a Multisensory Augmented Reality Map for Blind and Low Vision People: A Participatory Design Approach', May, 2018.
[13] 'RNIB PenFriend 3 Audio Labeller', 2019, https://shop.rnib.org.uk/catalog/product/view/id/30463/s/penfriend3/category/870/.
Mantra Lingua. 'Home | DiscoveryPEN'. DiscoveryPEN. Accessed 12 July 2019. https://www.discoverypen.co.uk/home.
[14] Miele, Josh, and Greg Kehret. 'Braille and Tactile Maps, Doris W. Kahn Accessible Transportation Award'. Metropolitan Transportation Commission, 19 October 2016. https://mtc.ca.gov/whats-happening/news/special-features/braille-and-tactile-maps-doris-w-kahn-accessible.
[15] Ravensburger AG. 'Tiptoi® - Das Audiodigitale Lernsystem von Ravensburger'. Accessed 12 July 2019. https://www.ravensburger.de/entdecken/ravensburger-marken/tiptoi/index.html.
[16] Perkins School for the Blind. 'The Whole Campus in His Hands'. Perkins School for the Blind, 1 June 2012. https://www.perkins.org/stories/the-whole-campus-in-his-hands.
[17] Raonsquare. 'Raonsquare – Interactive · Creative · Innovative, Raon Means "Vibrant".' Accessed 24 June 2020. http://raonsquare.com/2014/.
[18] 'Tactile Images and Maps'. RNIB, 2015, https://www.rnib.org.uk/sites/default/files/tactile_images_and_maps_2015_brochure_low_res.pdf.
[19] Loo-Morrey, Dr. Marianne. 'Tactile Paving Survey'. Health and Safety Executive, 28 January 2005. https://www.hse.gov.uk/research/hsl_pdf/2005/hsl0507.pdf.
[20] Thies, S.B., L.P.J. Kenney, D. Howard, C. Nester, M. Ormerod, R. Newton, R. Baker, M. Faruk, and H. MacLennan. 'Biomechanics for Inclusive Urban Design: Effects of Tactile Paving on Older Adults' Gait When Crossing the Street'. Journal of Biomechanics 44, no. 8 (May 2011): 1599–1604. doi:10.1016/j.jbiomech.2010.12.016.
[21] NIDirect. 'Pedestrian Facilities for People with Visual Impairment'. Nidirect, 24 November 2015. https://www.nidirect.gov.uk/articles/pedestrian-facilities-people-visual-impairment.
[22] Ouchlets. 'The Secret Button at Pedestrian Crossings'. BBC News, 29 May 2013, sec. Ouch. https://www.bbc.com/news/blogs-ouch-22706881.

[23] Schadenbauer, Sandra, Alexander Nischelwitzer, Robert Strohmaier, and Gerhard Sprung. 'Innovative and Intuitive Hands-on Interaction with RFID to Enhance Digital Media Experience of Exhibits' 2009 29 November 2017.
[24] Idrees, Affan, Zahid Iqbal, and Maria Ishfaq. 'An Efficient Indoor Navigation Technique to Find Optimal Route for Blinds Using QR Codes'. In *2015 IEEE 10th Conference on Industrial Electronics and Applications (ICIEA),* 690–95, 2015. doi:10.1109/ICIEA.2015.7334197.
[25] Idrees, Affan, Zahid Iqbal, and Maria Ishfaq. 'An Efficient Indoor Navigation Technique to Find Optimal Route for Blinds Using QR Codes'. In *2015 IEEE 10th Conference on Industrial Electronics and Applications (ICIEA),* 690–95, 2015. doi:10.1109/ICIEA.2015.7334197.
[26] Schadenbauer, Sandra, Alexander Nischelwitzer, Robert Strohmaier, and Gerhard Sprung. 'Innovative and Intuitive Hands-on Interaction with RFID to Enhance Digital Media Experience of Exhibits' 2009 29 November 2017.
[27] AlZuhair, Mona Suliman, Abir Benabid Najjar, and Eiman Kanjo. 'NFC Based Applications for Visually Impaired People - A Review'. In *2014 IEEE International Conference on Multimedia and Expo Workshops (ICMEW),* 1–6, 2014. doi:10.1109/ICMEW.2014.6890657.
[28] Schadenbauer, Sandra, Alexander Nischelwitzer, Robert Strohmaier, and Gerhard Sprung. 'Innovative and Intuitive Hands-on Interaction with RFID to Enhance Digital Media Experience of Exhibits' 2009. 29 November 2017.
[29] Praveena, Mary, Teena Sree .G, Winonah Rajendran, and Pavithra .P. 'LIFI BASED INDOOR NAVIGATION SYSTEM FOR THE VISUALLY IMPAIRED PEOPLE'. International Journal of Engineering Applied Sciences and Technology 4, no. 9 (January 2020): 372–76.
[30] Khan, Akif, Shah Khusro, and Iftikhar Alam. 2018. 'BlindSense: An Accessibility-Inclusive Universal User Interface for Blind People'. Engineering, Technology & Applied Science Research 8 (April 2018): 2775–84. https://doi.org/10.48084/etasr.1895.
[31] Mulla, Afshan, Jaypal Baviskar, Amol Baviskar, and Aniket Bhovad. 'GPS Assisted Standard Positioning Service for Navigation and Tracking: Review Implementation'. *In 2015 International Conference on Pervasive Computing (ICPC)*, 1–6, 2015. doi:10.1109/PERVASIVE.2015.7087165.
[32] Gao, Yanbin, Shifei Liu, Mohamed Atia, and Aboelmagd Noureldin. 'INS/GPS/LiDAR Integrated Navigation System for Urban and Indoor Environments Using Hybrid Scan Matching Algorithm'. Sensors 15, no. 9 (15 September 2015): 23286–302. doi:10.3390/s150923286.
[33] Ahmetovic, Dragan, Cole Gleason, Chengxiong Ruan, Kris Kitani, Hironobu Takagi, and Chieko Asakawa. 'NavCog: A Navigational Cognitive Assistant for the Blind'. In Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services, 90–99. Florence Italy: ACM, 2016. doi:10.1145/2935334.2935361.
[34] Kyle, Kyle, Keith Salmon, Dan Thornton, Neel Joshi, and Meredith Ringel Morris. 2017. 'Eyes-Free Art: Exploring Proxemic Audio Interfaces For Blind and Low Vision Art Engagement'. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 1 (3): 1–21. https://doi.org/10.1145/3130958.
[35] Brock, Anke, Samuel Lebaz, Bernard Oriola, Delphine Picard, Christophe Jouffrais, and Philippe Truillet. 2012. 'Kin'touch: Understanding How Visually Impaired People Explore Tactile Maps'. In *Proceedings of the 2012 ACM Annual Conference Extended Abstracts on Human Factors in Computing Systems Extended Abstracts - CHI EA '12*, 2471. Austin, Texas, USA: ACM Press. https://doi.org/10.1145/2212776.2223821.
[36] Brock, Anke, Samuel Lebaz, Bernard Oriola, Delphine Picard, Christophe Jouffrais, and Philippe Truillet. 2012. 'Kin'touch: Understanding How Visually Impaired People Explore Tactile Maps'. In *Proceedings of the 2012 ACM Annual Conference Extended Abstracts on Human Factors in Computing Systems Extended Abstracts - CHI EA '12*, 2471. Austin, Texas, USA: ACM Press. https://doi.org/10.1145/2212776.2223821.
[37] National Institute of Building Sciences. 'Design Guidelines for the Visual Environment' 6 11 May 2015: 80.
[38] Real, Santiago, and Alvaro Araujo. 'Navigation Systems for the Blind and Visually Impaired: Past Work, Challenges, and Open Problems'. Sensors 19, no. 15 2019. https://doi.org/10.3390/s19153404.
[39] X.M.Almeida, Maria deFatima, Laura B. Martins, and Francisco J. Lima. 'Analysis of Wayfinding Strategies of Blind People Using Tactile Maps'. Procedia Manufacturing 3 2015: 6020–27. https://doi.org/10.1016/j.promfg.2015.07.716.
[40] Arduino. 'Arduino 101 | Arduino Documentation'. 9 October 2021. https://docs.arduino.cc/retired/boards/arduino-101-619.
[41] Massachusetts Institute of Technology. MIT App Inventor. Accessed 9 October 2021. https://appinventor.mit.edu/.

## BIBLIOGRAPHY


Ahmetovic, Dragan, Cole Gleason, Chengxiong Ruan, Kris Kitani, Hironobu Takagi, and Chieko Asakawa. 'NavCog: A Navigational Cognitive Assistant for the Blind'. In *Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services*, 90–99. Florence Italy: ACM, 2016. doi:10.1145/2935334.2935361.

Almeida, Maria & Martins, Laura & Lima, Francisco. "Analysis of Wayfinding Strategies of Blind People Using Tactile Maps". Procedia Manufacturing. 3. (2015). 6020-6027. 10.1016/j.promfg.2015.07.716.

AlZuhair, Mona Suliman, Abir Benabid Najjar, and Eiman Kanjo. 'NFC Based Applications for Visually Impaired People - A Review'. *In 2014 IEEE International Conference on Multimedia and Expo Workshops (ICMEW),* 1–6, 2014. doi:10.1109/ICMEW.2014.6890657.

Caddeo, P., Fornara, F., Nenci, A., & Piroddi, A.. Wayfinding tasks in visually impaired people: the role of tactile maps. Cognitive Processing, 7(1), (2006)168-169.

Espinosa, M. A. & Ochaita, E. Using tactile maps to improve the practical spatial knowledge of adults who are blind. Journal of Visual Impairment & Blindness, 92 (5), (1998). 338–345.

Espinosa, M. A., Ungar, S., Ochaita, E., Blades, M., & Spencer, C. "Comparing Methods for Introducing Blind and Visually Impaired People to Unfamiliar Urban Environments." Journal of Environmental Psychology, 18(3), (1998). 277-287.

Espinosa, M. A., Ungar, S., Ochaita, E., Blades, M., & Spencer, C "Comparing Methods for Introducing Blind and Visually Impaired People to Unfamiliar Urban Environments." Journal of Environmental Psychology, 18(3), (1998). 277-287.

Gao, Yanbin, Shifei Liu, Mohamed Atia, and Aboelmagd Noureldin. 'INS/GPS/LiDAR Integrated Navigation System for Urban and Indoor Environments Using Hybrid Scan Matching Algorithm'. Sensors 15, no. 9 (15 September 2015): 23286–302. doi:10.3390/s150923286.

Idrees, Affan, Zahid Iqbal, and Maria Ishfaq. 'An Efficient Indoor Navigation Technique to Find Optimal Route for Blinds Using QR Codes'. In *2015 IEEE 10th Conference on Industrial Electronics and Applications (ICIEA),* 690–95, 2015. doi:10.1109/ICIEA.2015.7334197.

Lahav, O. & Mioduser, D. (2008). Haptic-feedback support for cognitive mapping of unknown spaces by people who are blind. International Journal of Human-Computer Studies, 66(1), 23-35.

Loomis, J. M., Klatzky, R. L., Golledge, R. G., Cicinelli, J. G., Pellegrino, J. W., & Fry, P. A. "Nonvisual navigation by blind and sighted: Assessment of path integration ability." Journal of Experimental Psychology, General, 122(1), (1993). 73-91.

Mulla, Afshan, Jaypal Baviskar, Amol Baviskar, and Aniket Bhovad. 'GPS Assisted Standard Positioning Service for Navigation and Tracking: Review Implementation'. In *2015 International Conference on Pervasive Computing (ICPC),* 1–6, 2015. doi:10.1109/PERVASIVE.2015.7087165.

Papadopoulos, Konstantinos, Marialena Barouti, and Eleni Koustriava. 'Differences in Spatial Knowledge of Individuals With Blindness When Using Audiotactile Maps, Using Tactile Maps, and Walking'. Exceptional Children 84, no. 3 (1 April 2018): 330–43. doi:10.1177/0014402918764300.

Papadopoulos, Konstantinos & Barouti, Marialena. (2015). Cognitive maps of individuals with blindness for familiar spaces: Construction through tactile maps and direct experience. Turkish Online Journal of Educational Technology. Special issue. 96-101.

Praveena, Mary, Teena Sree .G, Winonah Rajendran, and Pavithra .P. 'LIFI BASED INDOOR NAVIGATION SYSTEM FOR THE VISUALLY IMPAIRED PEOPLE'. International Journal of Engineering Applied Sciences and Technology 4, no. 9 (January 2020): 372–76.

Real Valdés, Santiago & Araujo, Alvaro "Navigation Systems for the Blind and Visually Impaired: Past Work, Challenges, and Open Problems." Sensors. 19. . (2019). 3404. 10.3390/s19153404.

Thies, S.B., L.P.J. Kenney, D. Howard, C. Nester, M. Ormerod, R. Newton, R. Baker, M. Faruk, and H. MacLennan. 'Biomechanics for Inclusive Urban Design: Effects of Tactile Paving on Older Adults' Gait When Crossing the Street'. Journal of Biomechanics 44, no. 8 (May 2011): 1599–1604. doi:10.1016/j.jbiomech.2010.12.016.

Ungar, S., Blades, M., & Spencer, C., "The role of tactile maps in mobility training." British Journal of Visual Impairment, 11(2), (1993) 59-61.

# INCLUSIVE PLANNING AS THE NEW NORMAL! LESSONS FROM AL-KARAMA NEIGHBORHOOD IN DUBAI

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## INTRODUCTION

Rapid and large-scale development has been the hallmark of urbanism within the cities of the Arabian Gulf, particularly in Dubai [1]. As the city set out to build its image as an international hub, tremendous changes to its urban fabric took place, and with far-reaching consequences [2]. And while the newer areas of Dubai managed to address their global appeal through an architecture of 'spectacle,' older areas remain roughly unchanged and are usually ignored by development efforts. These older areas though are characterized by a long and rich history that often demonstrates the city's multicultural nature. Yet, they rarely see the investment that goes into the newer areas of Dubai [3] – except if completely redeveloped or demolished [4]. Furthermore, they typically face issues related to neglect, gentrification, erosion of historical fabric, loss of identity, and commercialization -among others. And while neighborhood decline is a natural process across cities [5], in Dubai, the contrast with the newer areas is rather stark and leaves much to be desired for the residents of these older areas.

In this paper, we explore in-depth one of these older areas – namely Al-Karama District. Al-Karama is an important multicultural neighborhood in the heart of older Dubai and has been a haven for lower-income, multicultural residents until recently. It includes many low-rise housing units, often used as shared / informal accommodations, and a large number of business establishments, including ethnic restaurants [6]. Al-Karama is a melting pot that has a long and important history but suffers from typical signs of neighborhood decline. As of recently, the neighborhood has been receiving more attention from the authorities, and some private-sector re-investment is taking place, along with some changes to infrastructure [7]. Streets have been widened, and new housing units have started to replace the older ones. The introduction of a metro station has also had an implication for the neighborhood and increased its desirability. All these changes have had positive effects relative to the neighborhood's image yet have been slowly eroding away at the multicultural nature of the area, the street life, and displacing the lower-income segments.

To address the current changes in Al-Karama, this paper proposes an alternative, community-focused development approach. The paper starts by providing some background relative to inclusive urbanism, and gulf urbanity in general, and some information about the case study. The paper then proposes a masterplan for the area named '*La Karama'*. This new vision adopts a more inclusive approach to redevelopment and factors in the delicate demographics within the area. Based on some fieldwork, including interviews with residents, and documentation of various aspects relative to housing and street life within Al-Karama, the proposal hopes to shed some light on the inherent

potential of the neighborhood. It also hopes to give voices to those lower-income segments living in Al-Karama – by including them in the redevelopment process. Some of the findings from the fieldwork highlighted the need for communal public spaces as a top priority. They also point to the importance of maintaining the unique identity of the area, including existing street life, in any future development plans. Some of these street life and community space needs appeared to be even more critical during the Covid-19 lockdown period. Some of the work showcased in this paper was part of the winning entry for "*C40: Students re-inventing cities"* competition, as submitted by the authors [8] .

## Urban Development and Socially Inclusive City Planning

Urban development is a complex process that involves various stakeholders and often conflicting interests [9]. Within cities around the world, various economic, social, and practical considerations shape and 'sculpt' the urban environment -often to the advantage of some and at the expense of others. This is probably most noticeable in older neighborhoods undergoing redevelopment processes, where *gentrification* and demographic changes become an expected and observed by-product [10].

Overall, formal governmental planning systems undergo pressure from two different sides. On the one hand, the economic side favors favor less regulation and government intervention in the planning process. On the other hand, the social side focuses more on inclusivity and equity in planning [11]. Historically, the failure of the welfare state and the government-led centralized planning approaches during the 1960s and 70s, especially in the western world, caused the rise of 'splintered' urbanism [12]. Based on neoliberal policies to urban development, splintered urbanism views city planning as individual projects instead of a comprehensive, coordinated effort. This approach to planning which remains common today, especially in rapidly urbanizing cities of the global south, increased social exclusion and the marginalization of certain groups within society – including removing them from the planning process [13].

More recently, there has been increased pressure on urban planners and city officials to refocus planning and urban design efforts in a more equitable fashion to offset some of the negative impacts of private sector-led development efforts [14]. Inclusive design, which simply refers to design and developments which cater to most people, has been increasing in importance [15]. As a result of the increase of the world's urban populations to unprecedented levels and the negative impacts of market-driven planning -especially in the large cities of the global south, the need for equitable, participatory, and sustainable planning approaches has become greater and more evident [16].

As inclusive planning ideally relates to the questions of citizenship and rights, questions about the inclusivity of planning measures become even more contested in rapidly globalizing 'world cities" [17]. In such cities, large flows of migrant labor and polarization of society are the norm, and therefore questions about representation and right to the city become even more critical [18].

## Urbanism in Dubai and the Arabian Gulf

Dubai's urban development has become famous due to its 'apparent' emphasis on privilege, and it's rapid, often described as 'instant' growth [19]. Historically a small fishing town, Dubai emerged as a global business and tourist hub seemingly overnight. As of late, the city has been transformed into a well-known global destination and often is featured on the list of global cities and top tourist and work/live destinations.

Generally, the urban form in Dubai has undergone several stages reflecting diverse economic and regulatory approaches [20]. In their seminal work exploring housing affordability in Dubai, AlAwadi et al. [21]document the transformation of the urban form in the city from vernacular architecture in the older areas to more compact growth, and eventually into what the authors dub as "bigness" stage. This later stage reflects the adoption of neoliberal economic policies and the diversification of the

economy. It also reflects the dominance of powerful private developers, who often aim for signature developments and mega projects which are often designed by international firms and 'starchitects'. The later stage has arguably helped put Dubai on the global map of cities.

Another hallmark of Dubai's urbanism, which contrasts with the spectacular urbanism the city is famous for, is the abundance of informal public spaces and street life [22]. As a result of climatic conditions and the focus on the automobile in planning, formal public spaces are rather rare. Instead, street life appears mainly focused in older areas with lower-income demographics. These lower-income demographics also happen to be migrant workers from primarily Asian countries, which is typical in Gulf cities [23]. This informal street life has implications for the city's image and creates a somewhat conflicted impression of urbanism. It is also well documented in the literature describing the urban condition within Dubai [24]. This peculiar combination of demographics, income, and nationalities creates enclaves of different ethnic characters [25]. Meanwhile, some of the older areas in Dubai have crowded and informal housing problems and are somewhat chaotic in nature. Therefore, they are not always viewed in a positive light by the authorities. As a result, some of these bustling yet problematic areas are being lost as the city modernizes and expands. Few neighborhoods have been partially/ complexly razed to make way for newer developments, whereas the residents relocate to other older areas or areas in the periphery of the city [26]

The urban conditions relative to automobile dependence, polarized demographics, world-city aspirations, and developer-led planning are common across the Gulf cities [27]. The splintered nature of this development and the ethnic enclaves within these cities result in varying levels of development and modernization. The abundance of foreign, lower-income labor, especially from South-Asian countries, is another common theme across Gulf cities and is covered extensively in academic literature [28]

## METHODS

Al-Karama neighborhood was the case study for this research as described earlier. Fieldwork was conducted in the area by the research team during March 2021. Observational research focusing on public space usage and structured interviews with some residents (N=27) were also conducted. A design proposal was formulated based on these findings.

### Neighborhood Profile and Urban Analysis

*"You will rarely read about Karama outside local news, but it is historically significant to the city and its immigrants."* [29]

Al-Karama, a name which translates to *dignity* in Arabic, is a multicultural melting pot. Its historical significance especially outshines other neighborhoods in the city. Al-Karama's reputation stems from being one of Dubai's oldest retail-intensive areas, with a wide selection of retail, offices spaces, and eateries, in addition to an abundance of housing in the form of apartments. Its high restaurant concentration is also well recognized in the city, offering a wide variety of different ethnic cuisines, reflective of the demographics which reside in the area [30]

*Figure 1. Typical street view from Al-Karama neighborhood*

Located next to the Dubai Creek, a lively trading port, Al-Karama's genesis dates back to the early 1980s, in which the late Sheikh Rashid bin Saeed Al Maktoum provided sanctuary for around 8,000 Omanis [31]. Having been displaced from Zanzibar in the 1960s, these Omanis settled in the sizeable "Hamdan Colony," now a sub-neighborhood in the district. After a few years, Hamdan Colony became known as "7,000 buildings", a reference to the yearly rent in the block's apartment [32]. Having undergone a third metamorphosis, Hamdan Colony's housing units are currently renowned for sublet partition spaces and temporary bed renting, easily appealing to young male migratory workers, who take advantage of the relatively low prices in comparison to other parts of the city.

*Figure 2. Right: Map of Dubai, with Al-Karama marked. Left: Area of Focus within Al-Karama*

Despite its significance, especially its dominant South Asian expatriate population migratory population, and the important role Al-Karama has played in the history and development of the city of Dubai, the neighborhood is facing some profound changes to its fabric and character. Al-Karama has been undergoing a major transformation and upgrade. Its location between the old and new Dubai has increased its importance lately, especially with the introduction of the Dubai Frame landmark nearby [33]. This has brought some major developers into the area, and older buildings have been demolished in favor of newer, more 'image-fitting' buildings. These new structures naturally favor the wealthier segments, and the lower-income residents are being forced out due to increased rents. Other notable

interventions in the neighborhood include the commissioning of street art and murals, changes to traffic, and widening of streets [34] – though most of the lower-income residents cannot afford cars. While these interventions are welcomed for some, they tend to gentrify and alienate others who are being pushed out into the city's periphery.


*Figure 3. Breakdown and analysis on street level.*

**Design Proposal: *'La Karama'***

Considering the forces at play and the gentrification taking place in such a diverse and ethnically rich neighborhood, we consider the current top-down development approach unsuitable for such a delicate and important area. And so, at the center of our urban renewal proposal, "La Karama", are ALL the users and residents of the area, especially the lower-income ones. Through careful consideration of the general demographics and urban condition, the La Karama proposal centers around a number of strategic aims, including increasing the general quality of life, avoiding demolitions and (further) gentrification in the area, a focus on socioeconomic sustainability, the creation of accessible public spaces, and the creation of varied leisure and recreation zones. Considering the limited means of transport for the residents, La Karama also aims to celebrate the majority pedestrians and bike users through bike lanes, increased pavement space and increased vegetation to provide shade. Simple, accessible solutions are provided, ensuring a democratic and inclusive alternate urban environment.


*Figure 4. Left: Diagrammatic analysis of the different leisure zones. Right: Proposed Interventions*

Inclusive, generous, and well-planned public space could completely revive and revitalize the lost sense of community and identity in the area – therefore was a strategic focus for our proposal. The need for such planned spaces has proven more critical after the COVID-19 lockdown, as the residents of the areas suffered tremendously, especially at the beginning of the lockdown. Furthermore, these propositions were further supported by the fieldwork interviews, where the need for communal public spaces was emphasized consistently. Some of the telling comments we recorded in the interviews are listed below, demonstrating the importance of a user-centric approach to planning. Overcrowding and poor living conditions were often mentioned as an issue in the district, as well as problems in infrastructure (cracked pavements, leaking roofs, issues with air conditioning, among others).

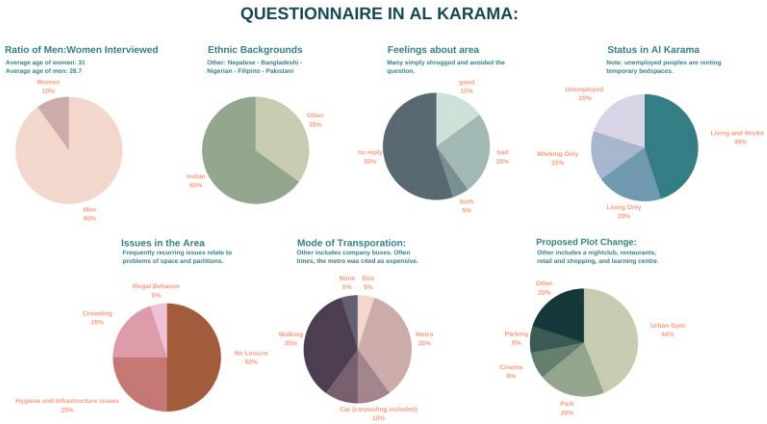


*Figure 5. Information from respondents*

*"There is no (purely) social area in Al-Karama", Comments for a Nepalese respondent, working in Al-Karama, but living in Satwa.*

*"There is 12 people in a partitioned room... It is a big problem because no one will clean", says one resident of the area, a 27-year-old man, who appear very enthusiastic at the idea of providing an outdoor gym as part of the proposal.*

*"Cycling is stressful and risky", describes one resident, hinting at the decaying infrastructure in the area, most notably the pavements. The resident also highlighted that he did not have the financial means to use different forms of transportation.*

Thus, La Karama's design approach was to listen to the community. Different public spaces were proposed, including, but not limited to: an outdoor gym, a small street library, and art center and art centers, music bars, and a new parking structure. The proposal also included small image enhancement interventions, and attention to detail, but without significant changes to the area. The goal was to demonstrate that La Karama area cares about and celebrates current and future residents! Some of the proposed interventions can be seen below

*Figure 6. Proposed interventions for different spaces in "La Karama".*

*Figure 7. Area of intervention*

## DISCUSSION AND CONCLUSION

The rapidly globalizing Arabian Gulf cities face tremendous pressures to modernize and compete on a global stage. In order to do so, older urban fabric and multi-ethnic areas and enclaves are being razed of redeveloped to cater to wealthier and more touristic-focused audiences. Within Dubai, these forces are evident throughout the city, with its high-end signature developments and its acquired status as a global destination for businesses and tourism alike.

While Dubai and other cities in the region are succeeding in their image-enhancing exercises, many changes are being made to the existing urban fabric, especially in the older areas like Al-Karama. Ethnic older neighborhoods, full of pedestrians, informal public spaces, and vibrant street life are being reconfigured. Though well-intended, these reconfigurations change the character of these areas and strip them from much of their much-desired charm. In Al-Karama for example, the upgrades taking place aim to make the neighborhood better. Still, the top-down approach to planning and the

absence of the user-voices leads to changes beyond the obvious - and usually at higher costs for lower-income segments. This is especially crucial in cities like Dubai due to the delicate demographics and the rather economically polarized society - with images of wealth and depravity within close proximity. Though we understand that there is a need to intervene in these older areas due to some unacceptable living and infrastructure conditions, in our opinion, the interventions should be delicate, inclusive, and participatory in spirit. We believe that our La Karama proposal does exactly that – provide change where needed, without changing too much of the neighborhood or negatively impacting its current residents.

On an encouraging note, the C40 competition -which was the inspiration for this work- was organized by the planning authorities in Dubai. This points to increased awareness of involving all stakeholders in the design process, especially in older areas such as Al-Karama. Covid-19, despite its negatives, also appears to have highlighted urban health (in its broad definition) as a strategic target for cities – including Dubai. So, this attention to Al-Karama, and the desire to plan cities in a more inclusive, user-centric fashion, is a step in the right direction and hopefully will become the new norm while planning other areas in the city.

## NOTES

[1] Bagaeen, “Brand Dubai: The Instant City; or the Instantly Recognizable City.”
[2] Alawadi, Khanal, and Almulla, “Land, Urban Form, and Politics: A Study on Dubai’s Housing Landscape and Rental Affordability”; Alawadi, “Urban Redevelopment Trauma: The Story of a Dubai Neighbourhood.”
[3] Elsheshtawy, *Dubai: Behind an Urban Spectacle*.
[4] Alawadi, “Urban Redevelopment Trauma: The Story of a Dubai Neighbourhood”; Duncan, “End of an Era as Dubai’s Jebel Ali Village to Be Redeveloped.”
[5] Bond and Coulson, “Externalities, Filtering, and Neighborhood Change.”
[6] Elsheshtawy, “Transitory Sites: Mapping Dubai’s ‘Forgotten’ Urban Spaces.”
[7] Shahbandari, “Brand New Karama, Dubai, Emerges from Low-Cost Expat Haven | Society – Gulf News.”
[8] Gulf News Report, “Dubai Announces Winner of a Competition to Develop a Urban Project to Redesign Al Karama | Uae – Gulf News.”
[9] Madanipour, “Roles and Challenges of Urban Design.”
[10] Wu, “State Dominance in Urban Redevelopment: Beyond Gentrification in Urban China.”
[11] Madanipour, “Roles and Challenges of Urban Design.”
[12] Graham and Marvin, *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*.
[13] Graham and Marvin; Swilling, “Contesting Inclusive Urbanism in a Divided City: The Limits to the Neoliberalisation of Cape Town’s Energy System:”
[14] Habitat, “Inclusive and Sustainable Urban Planning: A Guide for Municipalities (Vol. 1)”; UN-Habitat and WHO, *Integrating Health in Urban and Territorial Planning: A Sourcebook*; Belausteguigoitia, “Inclusive Urbanism, Sustainable Design and Community Engagement: A Holistic Approach.”
[15] Habitat, “Inclusive and Sustainable Urban Planning: A Guide for Municipalities (Vol. 1).”
[16] Belausteguigoitia, “Inclusive Urbanism, Sustainable Design and Community Engagement: A Holistic Approach.”
[17] Sassen, “G.2.1 The Global City: Introducing a Concept.”
[18] Ewers and Dicce, “Expatriate Labour Markets in Rapidly Globalising Cities: Reproducing the Migrant Division of Labour in Abu Dhabi and Dubai.”
[19] Bagaeen, “Brand Dubai: The Instant City; or the Instantly Recognizable City”; Pacione, “Dubai.”
[20] Alawadi, Khanal, and Almulla, “Land, Urban Form, and Politics: A Study on Dubai’s Housing Landscape and Rental Affordability.”
[21] Alawadi, Khanal, and Almulla, “Land, Urban Form, and Politics: A Study on Dubai’s Housing Landscape and Rental Affordability”
[22] Elsheshtawy, “Where the Sidewalk Ends: Informal Street Corner Encounters in Dubai.”
[23] Khalaf, “The Evolution of the Gulf City Type, Oil, and Globalization.”
[24] Elsheshtawy, “Where the Sidewalk Ends: Informal Street Corner Encounters in Dubai.”
[25] Khalaf, “The Evolution of the Gulf City Type, Oil, and Globalization.”
[26] Alawadi, “Urban Redevelopment Trauma: The Story of a Dubai Neighbourhood.”
[27] Khalaf, “The Evolution of the Gulf City Type, Oil, and Globalization”; Ponzini, “Large Scale Development Projects and Star Architecture in the Absence of Democratic Politics: The Case of Abu Dhabi, UAE.”
[28] Mohammad and Sidaway, “Spectacular Urbanization amidst Variegated Geographies of Globalization: Learning from Abu Dhabi’s Trajectory through the Lives of South Asian Men”; Rizzo, “Predatory Cities: Unravelling the Consequences of Resource-Predatory Projects in the Global South.”
[29] Ghaghada, “Jadaliyya - Karama: An Immigrant Neighborhood Transformed.”
[30] Javed, “Cool Neighbourhood in Dubai: 10 Reasons You Must Visit Karama | Magical-Staying-Connected – Gulf News.”
[31] Elsheshtawy, “Transitory Sites: Mapping Dubai’s ‘Forgotten’ Urban Spaces.”
[32] Shahbandari, “Brand New Karama, Dubai, Emerges from Low-Cost Expat Haven | Society – Gulf News.”
[33] Ghaghada, “Jadaliyya - Karama: An Immigrant Neighborhood Transformed.”
[34] Swan, “Street Art Turns Karama Turned into a Gallery on a Giant Scale.”

## BIBLIOGRAPHY


Alawadi, Khaled. “Urban Redevelopment Trauma: The Story of a Dubai Neighbourhood.” Built Environment 40, no. 3 (October 19, 2014): 357–75. https://doi.org/10.2148/benv.40.3.357.

Alawadi, Khaled, Asim Khanal, and Ahmed Almulla. “Land, Urban Form, and Politics: A Study on Dubai’s Housing Landscape and Rental Affordability.” *Cities* 81, no. April (November 2018): 115–30. https://doi.org/10.1016/j.cities.2018.04.001.

Bagaeen, Samer. “Brand Dubai: The Instant City; or the Instantly Recognizable City.” International Planning Studies 12, no. 2 (May 9, 2007): 173–97. https://doi.org/10.1080/13563470701486372.

Belausteguigoitia, Jone. “Inclusive Urbanism, Sustainable Design and Community Engagement: A Holistic Approach,” 2019. https://doi.org/10.2495/SC190121.

Bond, Eric W, and N Edward Coulson. “Externalities, Filtering, and Neighborhood Change.” Journal of Urban Economics 26, no. 2 (1989): 231–49.

Duncan, Gillian. “End of an Era as Dubai’s Jebel Ali Village to Be Redeveloped.” The National. October 30, 2021. https://www.thenationalnews.com/uae/2021/10/30/end-of-an-era-as-jebel-ali-village-to-be-redeveloped/.

Elsheshtawy, Yasser. *Dubai: Behind an Urban Spectacle*. London: Routledge, 2010.

———. “Transitory Sites: Mapping Dubai’s ‘Forgotten’ Urban Spaces.” International Journal of Urban and Regional Research 32, no. 4 (December 2008): 968–88. https://doi.org/10.1111/j.1468-2427.2008.00819.x.

———. “Where the Sidewalk Ends: Informal Street Corner Encounters in Dubai.” Cities 31 (April 2013): 382–93. https://doi.org/10.1016/j.cities.2012.12.001.

Ewers, Michael C., and Ryan Dicce. “Expatriate Labour Markets in Rapidly Globalising Cities: Reproducing the Migrant Division of Labour in Abu Dhabi and Dubai.” Journal of Ethnic and Migration Studies 42, no. 15 (December 7, 2016): 2448–67. https://doi.org/10.1080/1369183X.2016.1175926.

Ghaghada, Bhoomika. “Jadaliyya - Karama: An Immigrant Neighborhood Transformed,” January 19, 2021. https://www.jadaliyya.com/Details/42250.

Graham, Steve, and Simon Marvin. *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*. London: Routledge, 2002.

Gulf News Report. “Dubai Announces Winner of a Competition to Develop a Urban Project to Redesign Al Karama | Uae – Gulf News.” *Gulf News*. October 28, 2021. https://gulfnews.com/uae/dubai-announces-winner-of-a-competition-to-develop-a-urban-project-to-redesign-al-karama-1.83276706.

Habitat, U. N. “Inclusive and Sustainable Urban Planning: A Guide for Municipalities (Vol. 1).” Nairobi: UN HABITAT, 2007.

https://unhabitat.org/sites/default/files/download-manager-files/A guide for Municipalities Inclusive and Sustainable Urban Development Planning %2C Volume 1.pdf.

Javed, Nilanjana G. “Cool Neighbourhood in Dubai: 10 Reasons You Must Visit Karama | Magical-Staying-Connected – Gulf News.” *Gulf News*. December 9, 2021. https://gulfnews.com/magical-dubai/staying-connected/cool-neighbourhood-in-dubai-10-reasons-you-must-visit-karama-1.1638879844292.

Khalaf, Sulayman. “The Evolution of the Gulf City Type, Oil, and Globalization.” In *Globalization and the Gulf*, edited by John W. Fox, Nada Mourtada-Sabbah, and Mohammed Al Mutawa, 254–75. New York: Routledge, 2006.

Madanipour, Ali. “Roles and Challenges of Urban Design.” Journal of Urban Design 11, no. 2 (2006): 173–93. https://doi.org/10.1080/13574800600644035.

Mohammad, Robina, and James D. Sidaway. “Spectacular Urbanization amidst Variegated Geographies of Globalization: Learning from Abu Dhabi’s Trajectory through the Lives of South Asian Men.” International Journal of Urban and Regional Research 36, no. 3 (May 2012): 606–27. https://doi.org/10.1111/j.1468-2427.2011.01099.x.

Pacione, Michael. “Dubai.” *Cities* 22, no. 3 (June 2005): 255–65. https://doi.org/10.1016/j.cities.2005.02.001.

Ponzini, Davide. “Large Scale Development Projects and Star Architecture in the Absence of Democratic Politics: The Case of Abu Dhabi, UAE.” *Cities* 28, no. 3 (2011): 251–59.

Rizzo, Agatino. “Predatory Cities: Unravelling the Consequences of Resource-Predatory Projects in the Global South.” *Urban Geography* 40, no. 1 (January 2, 2019): 1–15. https://doi.org/10.1080/02723638.2018.1505156.

Sassen, Saskia. “G.2.1 The Global City: Introducing a Concept.” *The Brown Journal of World Affairs* XI, no. 2 (2005): 27–40. https://doi.org/Article.

Shahbandari, Shafaat. “Brand New Karama, Dubai, Emerges from Low-Cost Expat Haven | Society – Gulf News.” Gulf News . September 27, 2018. https://gulfnews.com/going-out/society/brand-new-karama-dubai-

emerges-from-low-cost-expat-haven-1.2283036.
Swan, Melanie. “Street Art Turns Karama Turned into a Gallery on a Giant Scale.” The National. August 4, 2016. https://www.thenationalnews.com/business/travel-and-tourism/street-art-turns-karama-turned-into-a-gallery-on-a-giant-scale-1.147663.
Swilling, Mark. “Contesting Inclusive Urbanism in a Divided City: The Limits to the Neoliberalisation of Cape Town’s Energy System:” *Http://Dx.Doi.Org/10.1177/0042098013505160* 51, no. 15 (September 24, 2013): 3180–97. https://doi.org/10.1177/0042098013505160.
UN-Habitat, and WHO. *Integrating Health in Urban and Territorial Planning: A Sourcebook*, 2020. https://unhabitat.org/sites/default/files/2020/05/1-final_highres_20002_integrating_health_in_urban_and_territorial_planning_a_sourcebook.pdf.
Wu, Fulong. “State Dominance in Urban Redevelopment: Beyond Gentrification in Urban China.” Urban Affairs Review 52, no. 5 (2016): 631–58. https://doi.org/10.1177/1078087415612930.

# PERCEPTUAL INFLUENCES OF BUILT ENVIRONMENT ON BRAIN: A NEUROMORPHIC PERSPECTIVE

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## INTRODUCTION

The disruptions caused by COVID-19 pandemic in everyday lives worldwide have been far reaching, with effects seen in both tangible and intangible ways. Consequently, the pandemic response has highlighted various spatial contestations and negotiations such as–isolation, inaccessible or reduced access to public spaces, concepts of fragility, reduced mobility, amongst others. These contestations and negotiations have been further affected by socio-material interactions in everyday life through daily technology use, digital readiness, and increasing technology dependencies, leading to a renewed focus on users in today's technologically mediated societies. This has led praxis and academia to seek an in-depth understanding of the pivotal role architecture and built environment play in physical and mental wellbeing. Earlier studies in the field of functional brain imaging have led to the intersection of neuroscience research with the fields of planning and architectural design, by highlighting the embodiment of the built environment into our daily sensorial experience. Neuroarchitecture is the interdisciplinary field that studies creation of environments to optimize the brain performance, human behavior and well-being. Moreover, with the pandemic highlighting effects of socio-spatial and socio-material interactions to public health, an in-depth understanding into perceptual influences of built environment on human brain can provide architects, planners, health care providers, governance actors and development practitioners a theoretical framework to adapt and create more responsive, healthy and sustainable public and built spaces.

This review paper thus, aims to firstly, to highlight the various interaction between the human brain and the environment, secondly; analyze the association between neuroscience and architecture, and lastly, explore the benefits of contribution of neuroscience in designing built environments. Through a literature review performed through studies in neuroscience, cognitive and behavioral sciences intersecting with spatial and/architectural design elements, the paper assess the neurological findings in creating a healthy built environment. Findings reveal that methodological frameworks from neuroscience studies can inform user perception and behavior, thereby influencing and shaping built environments.

### Impact of Built Environment on the Neuroscience

As we spend our major lifetime in the built environment, it therefore plays a role in our physical and mental health. Growing research has been undertaken by the Academy of Neuroscience for Architecture to study physiological responses to the built environment through the concept of 'neuro-

architecture'. The Academy of Neuroscience for Architecture (ANFA) took shape in 2002 as a project by the American Institute of Architects (AIA). The project led to the establishment of an organization in 2003 that aimed at expanding body of research on understanding human responses to built environment[1]. Neuroarchitecture received further recognition when the Nobel Prize in Physiology/Medicine for 2014 was awarded in the field of neuroscience applied to architecture–the Nobel laureates discovered an 'inner GPS' in the brain that made it possible for humans to orient themselves in space, thereby highlighting the link between cognitive function and spatial orientation and navigation[2]. Since then, interdisciplinary studies are being conducted to investigate the intersection of architectural design and neuroscience for improving health and well-being. The following paragraphs exemplify some key findings from earlier studies.

Earlier research has highlighted the influence of different interior-built environments and geometries on the human brain. Studies reported that curvature geometries made higher pleasure ratings, and increased theta activity in the anterior cingulate cortex (ACC) of brain, whereas rooms with more linear geometries made lower pleasure[3]. In interior hospital settings, impact of the curve and sharp contours on patterns of amygdala activation and behavioral response was studied using functional MRI[4]. There was higher amygdala activation in stimuli including landscape and healthcare objects associated with sharp contours which may trigger fear response[5]. These studies help stress the impact of architectural design through shapes on human perception through a neurophysiological analysis.

Additionally, existing research in neuroscience, psychology, and cognitive science also illustrate the impact of the built environment on human experience. Environmental psychologists working on attention restoration theory proposed that nature had the ability to restore people's attention and release stress[6]. Studies indicated people preferred natural environments or built environments with water, trees, and other vegetation (i.e., nature mimicking features)[7]. Subsequent studies on surgery patients in hospitals also highlighted a correlation in rooms with a natural scenic view and shorter post-operative hospital stays, leading to further research and development of fields such as nature-based solutions in built design, green facades, etc. to explore how building an environment that mimics, or provides access to nature impacts well-being in humans[8]. Similarly, cognitive behavioral research in school children revealed that students scored better on a selective attention test when their classrooms had green walls[9]. The positive effects observed in children from the green wall were consistent with earlier research highlighting how a natural (or nature-mimicking colors) environment can support and enhance cognitive functions and evoke feelings of comfort.

Moreover, researchers have also observed that ambient light and its physical characteristics modulate brain function and cognition[10]. Physical characteristics of lighting which impacts short-term psychological and physiological effects are light levels, light color, spectral distribution, and temporal patterns[11]. Circadian rhythm (sleep-wake cycle) researchers reported long-term psychological and physiological effects from non-visual aspects of light[12] and research on conditions such as "biological darkness"[13] (i.e., light good enough to see but not good enough to support sleep-wake cycle) stated respondents experiencing fatigue and excessive sleeping[14]. These findings emphasize how ample access to daylight and artificial lighting in built environments can affect and regulate the occupant's natural sleep-wake rhythm and human physiology. As seen in covid lockdown and ongoing pandemic city responses, the time spent indoors is substantially more than outdoor. Therefore, this showcases the need to evaluate impact on people's well-being and productivity in post-pandemic everyday routines, that are informed by circadian rhythm and interior lighting conditions. The next section will focus on the spatial design of the built environment and its influence on cognitive behavior and well-being.

## Priming the Brain through Built Environment

The five areas often studied in brain systems/neuromorphic architecture are: (1) sensation and perception (how do we see, hear, smell, taste, etc.?), (2) learning and memory (how do we store and recall our sensory experiences?), (3) decision making (how do we evaluate the potential consequences of our actions?), (4) emotion & effect (how do we become fearful or excited? or what makes us feel happy or sad?) and (5) Movement (how do we interact with our environment & navigate through it?). Through neuroscientific methods, spatial design has been explored in various studies to understand human perception and action, to create better sensory experiences. The following paragraphs highlight key methods in neuroscience such as priming, functional MRI, electroencephalograph (EEG), environment enrichment (EE) and their intersection with spatial design and the consequent effects on usage of the built environment.

Earlier research highlights that the spatial design of the built environment can influence the mental status of the people occupying that space by modulating their attitudes and behavior[15]. Neuroscience research defines this modulation and influence as "priming"– which involves introduction of a stimulus impacting later behavior of the person even if they cannot remember the stimulus. The stimulus can be–word, image, sound or a design. To exemplify, researchers reported the effects of building ceiling heights on the ability of problem solving. Observations revealed that images of high ceilings gave the brain a feeling of freedom, thereby improving creativity and spontaneous behavior; whereas low ceiling increased focus and concentration[16]. Therefore, spatial design interventions can be used to influence user behavior and brain physiology.

Additionally, existing research has also emphasized how viewing buildings designed for contemplation may induce experiential and brain signatures that are different from those induced by buildings that serve everyday functions[17]. This was researched using the method– "Functional MRI", wherein pictures of ordinary and contemplative architecture were studied. Findings indicated that images of contemplative buildings induced attentive, receptive, and absorbing experiences. Hence, visualizing spatial design could be used for cultivating contemplation in users. Furthermore, cognitive health research has used methods such as "environmental enrichment" to measure neurophysiological responses to explore the impact of indoor environments on human health. EE often includes bringing nature into the built environment to improve the wellbeing of occupants. Studies have highlights how EE can posit restorative environments in healthcare facilities by aiding patient recovery and reduced pain medications[18] and create safe or comfortable sensations through constant contact with materials such as wood[19]. EE has also been used as a method to furnish elderly care residences with their personal furniture, thereby providing support for episodic memory in Alzheimer patients and reducing stress, anxiety and aggression[20] . Lastly, EEG has been used in diverse studies where researchers record participants electrical activity of the brain to better understand an environments influence. One such study focused on how participants' attitude toward the doors of different sizes changed as participants learnt whether doors were passable. Participants confronted simulated doors of different widths: Narrow (0.2 m wide), medium (1 m), wide (1.5 m). Initial analysis of visual information showcased that neural activity depended on whether the door was perceived as passable or not. The results supported the view that perception is shaped by the possibilities of imminent action[21].

All these methodologies and technological developments can hence provide an understanding of brain's functionality & the significance of design that improves user experience. Moreover, these developments could also be viewed as an effort to understand the widespread role of spatial design in active human behavior.

## CONCLUSION

The COVID-19 pandemic has brought forth how public health and city planning are intrinsically linked as cities undergo metamorphosis as a response to diseases. However, as exemplified in this review, scientific advancement in neuroscience and cognitive science has the potential to inform architectural design with greater rigor. The built environment and the human brain both are complex structures and study of their intersection can provide bi-directional benefits to architects as well as neuroscientists. By binding architecture & neuroscience, a pivotal point of transition for disciplinary breakthroughs can be offered. Moreover, application of new approaches created at the interface between neuroscience & architecture can create the source for the “evidence” in evidence-based design. Lastly, methodological advancement of architectural field can aid more responsive & responsible ways of designing that are also conducive to psycho-spatial wellbeing of city inhabitants.

## NOTES

[1] “History”, Academy of Neuroscience for Architecture, accessed January 12, 2022, https://anfarch.ucsd.edu/history.
[2] “Press release”, The Nobel Assembly at Karolinska Institutet, accessed January 12, 2022, https://www.nobelprize.org/prizes/medicine/2014/press-release/.
[3] Maryam Banaei, Javad Hatami, Abbas Yazdanfar, and Klaus Gramann. "Walking through architectural spaces: the impact of interior forms on human brain dynamics." Frontiers in human neuroscience 11 (2017): 477.
[4] Debajyoti Pati, Michael O’Boyle, Jiancheng Hou, Upali Nanda, and Hessam Ghamari. "Can hospital form trigger fear response?." HERD: Health Environments Research & Design Journal 9, no. 3 (2016): 162-175.
[5] Pati, O’Boyle, Hou, Nanda and Ghamari, 2016
[6] Roger S. Ulrich, Robert F. Simons, Barbara D. Losito, Evelyn Fiorito, Mark A. Miles, and Michael Zelson. "Stress recovery during exposure to natural and urban environments." Journal of environmental psychology 11, no. 3 (1991): 201-230.
[7] R. Kaplan, and S. Kaplan. "The Experience of Nature: A Psychological Perspective (Cambridge: CUP Archive)." (1989).
[8] Roger S. Ulrich, "View through a window may influence recovery from surgery." Science 224, no. 4647 (1984): 420-421.
[9] Agnes E.Van den Berg, Janke E. Wesselius, Jolanda Maas, and Karin Tanja-Dijkstra. "Green walls for a restorative classroom environment: a controlled evaluation study." Environment and Behavior 49, no. 7 (2017): 791-813.
[10] Agnes Daurat, Acacia Aguirre, Jean Foret, Philippe Gonnet, Anne Keromes, and Odile Benoit. "Bright light affects alertness and performance rhythms during a 24-h constant routine." Physiology & behavior 53, no. 5 (1993): 929-936.
[11] M. G. Figueiro, and M. S. Rea. "Office lighting and personal light exposures in two seasons: Impact on sleep and mood." Lighting Research & Technology 48, no. 3 (2016): 352-364.
[12] Gilles Vandewalle, Pierre Maquet, and Derk-Jan Dijk. "Light as a modulator of cognitive brain function." Trends in cognitive sciences 13, no. 10 (2009): 429-438.
[13] “We are living in biological darkness”, LYS Technologies, accessed on 12 January, 2022, https://lystechnologies.io/reflections/we-are-living-in-biological-darkness-in-conversation-with-jan-denneman/
[14] Daurat, Aguirre, Foret, Gonnet, Keromes and Benoit, 1993.
[15] Sally Augustin, Neil Frankel, and Cindy Coleman. *Place advantage: Applied psychology for interior architecture*. John Wiley & Sons, 2009.
[16] Joan Meyers-Levy, and Rui Zhu. "The influence of ceiling height: The effect of priming on the type of processing that people use." Journal of consumer research 34, no. 2 (2007): 174-186.
[17] Julio Bermudez, David Krizaj, David L. Lipschitz, Charles Elliott Bueler, Jadwiga Rogowska, Deborah Yurgelun-Todd, and Yoshio Nakamura. "Externally-induced meditative states: an exploratory fMRI study of architects’ responses to contemplative architecture." Frontiers of architectural research6, no. 2 (2017): 123-136.
[18] Ann Ojala, Kalevi Korpela, Liisa Tyrväinen, Pekka Tiittanen, and Timo Lanki. "Restorative effects of urban green environments and the role of urban-nature orientedness and noise sensitivity: A field experiment." Health & place 55 (2019): 59-70.
[19] Xi Zhang, Zhiwei Lian, and Yong Wu, “Human Physiological Responses to Wooden Indoor Environment,” Physiology and Behavior 174 (2017): 27–34, https://doi.org/10.1016/j.physbeh.2017.02.043.
[20] John Zeisel. "Observing environmental behavior. Chapter 9 in: Inquiry by design: Environment/behavior/neuroscience in architecture, interiors, landscape, and planning." (2006): 191-226.
[21] Sergei Gepshtein and Joseph Snider, “Neuroscience for Architecture: The Evolving Science of Perceptual Meaning,” Proceedings of the National Academy of Sciences of the United States of America 116, no. 29 (2019): 14404–6, https://doi.org/10.1073/pnas.1908868116.

## BIBLIOGRAPHY

Academy of Neuroscience for Architecture, “History”, accessed January 12, 2022, https://anfarch.ucsd.edu/history.

Augustin, Sally, Neil Frankel, and Cindy Coleman. *Place advantage: Applied psychology for interior architecture*. John Wiley & Sons, 2009.

Banaei, Maryam, Javad Hatami, Abbas Yazdanfar, and Klaus Gramann. "Walking through architectural spaces: the impact of interior forms on human brain dynamics." Frontiers in human neuroscience 11 (2017): 477.

Bermudez, Julio, David Krizaj, David L. Lipschitz, Charles Elliott Bueler, Jadwiga Rogowska, Deborah Yurgelun-Todd, and Yoshio Nakamura. "Externally-induced meditative states: an exploratory fMRI study of architects' responses to contemplative architecture." Frontiers of architectural research6, no. 2 (2017): 123-136.

Daurat, Agnes, Acacia Aguirre, Jean Foret, Philippe Gonnet, Anne Keromes, and Odile Benoit. "Bright light affects alertness and performance rhythms during a 24-h constant routine." Physiology & behavior 53, no. 5 (1993): 929-936.

Figueiro, M. G., and M. S. Rea. "Office lighting and personal light exposures in two seasons: Impact on sleep and mood." Lighting Research & Technology 48, no. 3 (2016): 352-364.

Kaplan, R., and S. Kaplan. "The Experience of Nature: A Psychological Perspective (Cambridge: CUP Archive)." (1989).

LYS Technologies, "We are living in biological darkness", accessed on 12 January, 2022, https://lystechnologies.io/reflections/we-are-living-in-biological-darkness-in-conversation-with-jan-denneman/

Meyers-Levy, Joan, and Rui Zhu. "The influence of ceiling height: The effect of priming on the type of processing that people use." Journal of consumer research 34, no. 2 (2007): 174-186.

Ojala, Ann, Kalevi Korpela, Liisa Tyrväinen, Pekka Tiittanen, and Timo Lanki. "Restorative effects of urban green environments and the role of urban-nature orientedness and noise sensitivity: A field experiment." Health & place 55 (2019): 59-70.

Pati, Debajyoti, Michael O'Boyle, Jiancheng Hou, Upali Nanda, and Hessam Ghamari. "Can hospital form trigger fear response?." HERD: Health Environments Research & Design Journal 9, no. 3 (2016): 162-175.

Sergei Gepshtein and Joseph Snider, "Neuroscience for Architecture: The Evolving Science of Perceptual Meaning," Proceedings of the National Academy of Sciences of the United States of America 116, no. 29 (2019): 14404–6, https://doi.org/10.1073/pnas.1908868116.

The Nobel Assembly at Karolinska Institutet, "Press release", accessed January 12, 2022, https://www.nobelprize.org/prizes/medicine/2014/press-release/.

Ulrich, Roger S., Robert F. Simons, Barbara D. Losito, Evelyn Fiorito, Mark A. Miles, and Michael Zelson. "Stress recovery during exposure to natural and urban environments." Journal of environmental psychology 11, no. 3 (1991): 201-230.

Ulrich, Roger S. "View through a window may influence recovery from surgery." Science 224, no. 4647 (1984): 420-421.

Van den Berg, Agnes E., Janke E. Wesselius, Jolanda Maas, and Karin Tanja-Dijkstra. "Green walls for a restorative classroom environment: a controlled evaluation study." Environment and Behavior 49, no. 7 (2017): 791-813.

Vandewalle, Gilles, Pierre Maquet, and Derk-Jan Dijk. "Light as a modulator of cognitive brain function." Trends in cognitive sciences 13, no. 10 (2009): 429-438.

Zeisel, John. "Observing environmental behavior. Chapter 9 in: Inquiry by design: Environment/behavior/neuroscience in architecture, interiors, landscape, and planning." (2006): 191-226.

Zhang, Xi, Zhiwei Lian, and Yong Wu. "Human physiological responses to wooden indoor environment." Physiology & behavior 174 (2017): 27-34.

# HEALTH AND NATURE: NEUROARCHITECTURE FOR THE RECOVERY OF HISTORICAL SPACES AND FOR HEALING FROM EATING DISORDERS. THE CASE OF VILLA ORTISI IN SIRACUSA, SICILY

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## INTRODUCTION

Public health and environmental challenges facing the world in the 21st century, including the ageing population, increasing urbanisation, the rise of non-communicable diseases and climate instability, require an interdisciplinary response. The focus on wellbeing, in the definition of health and prevention of the loss of vitality, has been diluted and overlooked. Already in 1959s Halbert L. Dunn had defined the welfare of high level "as an integrated method of functioning which is oriented toward maximizing the potential of which the individual is capable, within the environment (in which they) are functioning". In simplest form, the goal of high-level wellness was life with energy, vitality and zest, and it could only be concretized as a 'way of life'.[1]

The urgent task for environmental health is to provide deeper insight into the ways in which we develop relationships with nature and building, and how we feel in the natural and artificial (built by man) world. This includes the social, political, and economic underpinnings of nature relatedness and its impact on vitality at all scales.

Architecture and environment have effects on humans at the cognitive level (understood as the processing and appraisal of perceived information) and the emotional level (understood as the adaptive reactions to the perceived information), which both operate through closely interrelated systems. For example, it has been found that noise and a lack of vegetation can generate stress that can even negatively affect life expectancy.[2] Thus, the architecture has cognitive-emotional repercussions. "Designerly ways of knowing" (distinct from the best-known scientific forms of knowledge[3]) has been, traditionally, the main way to address the cognitive-emotional dimension of architecture[4]. Through this way, architects have explored and exploited some of the perceptual foundations of the experience of space.[5]

For some decades scholars have been increasingly aware of the responsibility that architects have in designing places that can help man to live better and contribute to his well-being. Many experts have understood that living and working environments are fundamental to health and well-being.

In particular, today it is important to evaluate the influence of the physical characteristics of the places where man lives. In the current framework of the International Classification of Functioning, Disability and Health (ICF), such contextual factors are regarded as either facilitators of, or barriers

to, a person's functioning. This development mirrors recent interest within the field of architecture and design in the effect of man-made structures on the human central nervous system.[6]
Research explores the perceptual dynamics of man - space through the principles of neuroarchitecture.

## NEURO-ARCHITECTURE AND REUSE

Neuro-architecture is the discipline that studies human behavior in response to interaction with different environments. Every place triggers a different reaction, emotion and thought in the brain.[7]
The perspective of work is to look for ways to give rise to innovative spatial concepts to relate architecture, mind and body. Neuroscience takes its inspiration from the holistic understanding of human life that Moholy-Nagy expected from architects[8]. She has certainly been an integral part of many of Arnheim's[9] studies on visual perception and consolidates with Richard Neutra and his idea of incorporating neuroscientific knowledge into architecture[10], reconciling scientific approach with field experience. Different and various study were done on light and acoustic by medical researchers.
At the end of the last century, the neuroscientist Dr. Fred Gage studied the effects of environmental changes on the mind that «interprets, analyzes and reconstructs the space that surrounds it». When you enter an environment, the brain creates cognitive maps that, in relation to spatial distribution, affect emotions. Gage's statement "Changes in the environment change the brain, and therefore they change our behavior"[11] stresses the interactions between spaces and behavior and the responsibilities that architects should assume regarding the effects of the project on the psycho-physical well-being of users.
The first examples of neuroarchitecture are related to the design of hospital structures. Roger Ulrich of Texas A&M University[12] conducted a study in the late 1900s on nature-based health design that, with architecture, cures those who suffer. A methodology that identifies, in the open space, ideal places for care of patients who can perform recreational, rehabilitative, social, playful and sports and are perceived as an extension of the health facility. [13] It gives patients a feeling of greater autonomy, freedom and leisure, even when they cannot physically enjoy it.[14]
In 2003, the ANFA (Academy of Neuroscience for Architecture) was founded; it included many lines of research activities, conducted in synergy with the Academy of Health Care Architecture, aimed at the design of health facilities testing solutions, not only compatible with the health status of the occupants, but able to condition the therapeutic process towards healing.[15]
Although Neuro-architecture has its roots in antiquity, its application has been established in our century following the research that led to define the plasticity of the human brain: the ability to produce neurons in adulthood according to lived experiences. The implications in the field of architectural design have been developed around the definition of the quality of spaces able to improve cognitive functions, enhance mnemonic processes, control stress. Research by neuroscientists has shown that there are areas of the brain that activate when an individual is in a place and recognizes him on the basis of his accumulated memories or catalogues him as new and unknown. You can reduce the feeling, linked to the stress of the user entering an environment avoiding intense lights, crowding, sharp edges and placing more points of reference.
With the right application of the discipline, you can design schools in which concentration is facilitated, health facilities in which the emotional component, placed in the foreground, dominates the disease, offices in which the creative and productive component is encouraged.
Even the design of outdoor environments can see the contributions of neuro-architecture: nature helps the human psyche and improves mood, reducing stress. The environments surrounded by greenery or with a wide view of natural landscapes help to improve the psychological well-being of people.
The designer can therefore make use of the notions provided by neuro-architecture, such as the use of colors, which condition mood, decisions and attitudes:

• Yellow: brightens the poorly lit and small spaces;
• Orange: stimulates physical activity and respiratory and eye system;
• Red: increases visual complexity, stimulates nervous and glandular activity;
• Violet: used in small quantities shows analgesic effects;
• Blue: expands space and calms the nervous system;
• Green: stimulates brain activity, but if too bright is irritating;
• Brown: if it is made of natural material, it gives a feeling of comfort.

The research developed explores the possibilities of applying the principles of neuro-architecture to the reuse of buildings for health purposes. These interventions are governed by design processes organized around the assessments of compatibility between the quality and performance offered by the building and the requirements placed in the field by uses other than the original.

In the proposed case study, the audit concerned a disused building for its possible redevelopment for the health care of Eating Behavior Disorders patients. Such a project has to deal with a number of needs that fall under the most recent concepts of health care, such as:

• the humanization of the place of care;
• the suitability of spaces for specific therapeutic pathways.

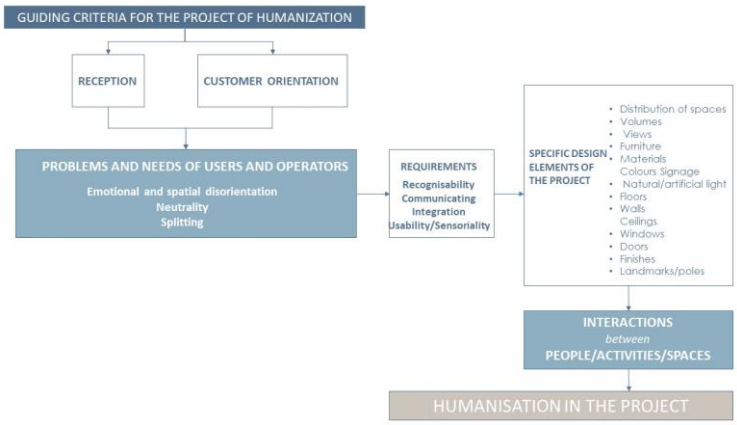


*Figure 1. Criteria for the humanization project.*

## THE CASE STUDY: VILLA ORTISI IN SYRACUSE

Villa Ortisi is located in the Tiche district, one of the oldest districts of Syracuse, one of the five of Greek foundation, a holiday resort for wealthy families at the end of the Nineteenth century. The building was built by Cavalier Eustachio Ortisi (1852-1928), who was the Bank of Italy's manager, probably between 1885 and the beginning of the 20th century. The first official plan in which the villa is clearly visible is from 1925.[16] The villa was sold to the City of Syracuse in 1931.

The building is a simple volume, on three levels, marked vertically and horizontally by the rhythm of large windows; it has a pavilion roof on which a terrace is inserted. There is a level under the roof, smaller and visible only on a prospectus. The façades have large rectangular windows defined by white stone frames of Syracuse and some small circular windows. On the original main façade there is a rectangular loggia composed of three arches on the long sides and one on the short ones, marked by columns with Ionic capital and trabeation. The decorative elements are a reinterpretation of shapes and styles, typical of eclecticism. Near the villa there are a small private chapel, rural buildings, a large garden and a gym built in the second half of the twentieth century. Compared to the villas in the area, Villa Ortisi is more imposing because it is set on three levels plus a semi-basement floor, instead of two.


*Figure 2. Landscape framework and localization view of Villa Ortisi, Syracuse, Sicily, Italy.*

Over time, the City of Syracuse divided the lot by renting the rural part to a Recovery Center for Drug Addicts (Rebirth Community) and placing on the land surrounding the Municipal Nursery.[17] In the forecasts of several general regulatory plans the villa was to host an Institute for the reeducation of the blind or a retirement home for the elderly.

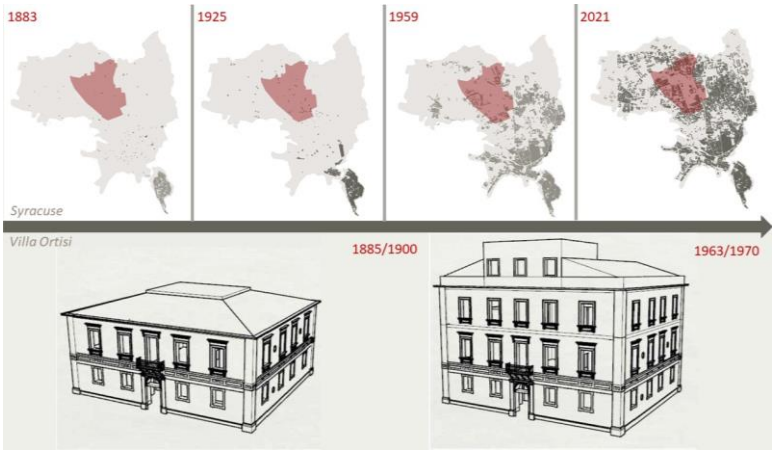


*Figure 3. Historical evaluation of Syracuse and Villa Ortisi.*

The villa hosted an elementary school from the late '60s until 2005, when it was abandoned for lack of seismic adjustment. A gym was built at that time.
A project for seismic and fire-fighting adaptation was drawn up in 2012, including the installation of an elevator and the construction of a new stairwell. These interventions were carried out by demolishing original floors and vaults. The works have never been completed, leaving walls and walls without finishes and systems. Today the villa has suffered acts of vandalism, has become a landfill of dangerous material (ethernit), has been illegally occupied by non-EU and has been infested by rodents and small animals.

## RESEARCH AND THE PROJECT

The research applied the concepts of neuroarchitecture to the case study, deepening historical, sociological and functional aspects. In particular, the urgent requests for health services by the Community and numerous meetings with neuropsychiatrists of the hospital of Syracuse led to the determination that the villa should become a place of rehabilitation, also given the proximity to the hospital. The study carried out on the shortcomings of local and regional health services highlights the need to create places for the treatment of mental disorders, linked to food behavior. Such pathologies are difficult to treat, involve the family sphere and require periods of stay in special facilities because outpatient therapy is not enough. The best treatment is, according to all neuropsychiatrists consulted, a residential rehabilitation facility where the patient, depending on the stage of the disease, can follow a path of residential rehabilitation, semi-residential or outpatient.

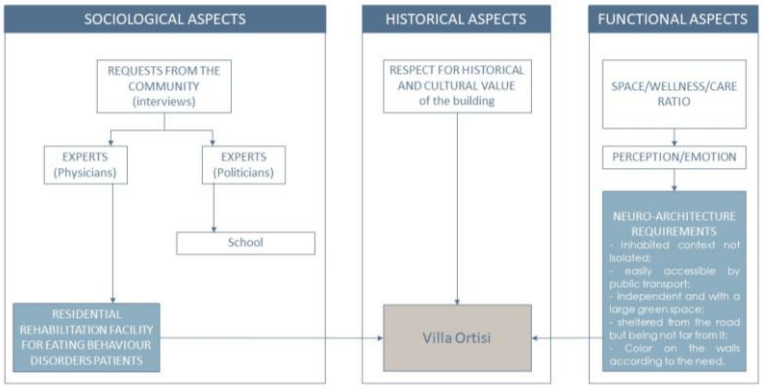


*Figure 4. Method scheme for Villa Ortisi project.*

The Resolution of the Sicilian Regional Council n. 14 of 2014 indicates the minimum requirements necessary to achieve a rehabilitative structure of this type; the research, through consultation of experts and the application of the principles of neuro-architecture, identified prerequisites for implementing a correct approach to the disease. A list of the areas to be covered during the design phase has been drawn up.

### Functional-Distributive Requirements

• Rooms with one or two beds, respectively 9 or 14 sqm minimum, a wardrobe and personal spaces. All of these rooms shall be on one level;
• 1 bathroom for every 4 beds, outside the rooms and with the possibility of being closed after meals, with locks that can be opened from the outside, in case of emergency;
• n. 1 bathroom, and a changing room for medical staff;

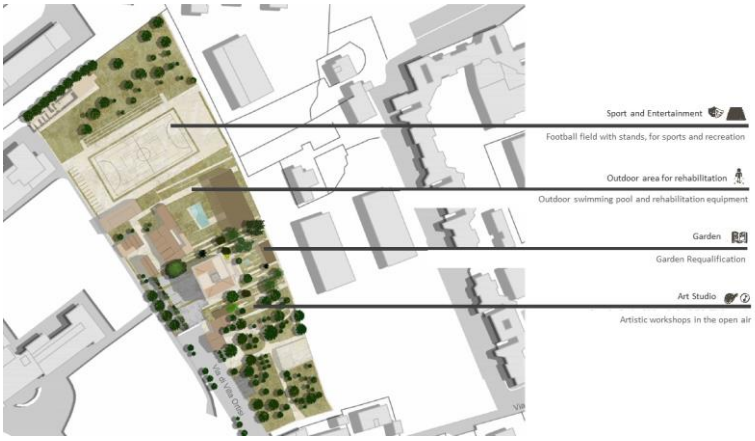


*Figure 5. Masterplan for Villa Ortisi re-use, Syracuse, Sicily, Italy.*

• an infirmary for each floor, with spaces suitable for the preparation of therapies, a bed and cupboard and refrigerator for medicines;
• therapeutic laboratory spaces;
• recreational spaces;
• classroom study for underage patients attending school;
• a canteen equipped with tables with two or more positions;
• a kitchen of 12 square meters minimum, with the possibility of laboratory-therapeutic use, and open only if necessary;

• clinics, with a position for each doctor: 1 neuropsychiatrist of childhood and adolescence, 1 psychologist-psychotherapist, 1 social worker, 1 dietician;
• spaces for interviews and meetings;
• archive;
• a laundry, ironing and pantry;
• space for rehabilitative activities.

### Requirements For Neuro-Architecture

• Located in an inhabited context not isolated;
• easily accessible by public transport;
• independent and have a large green space;
• sheltered from the road but being not far from it;
• Color on the walls according to the need: natural color (wood) gives feeling of comfort, the green stimulates brain activity and soothes, the blue expands the space and instills calm to the nervous system, the yellow brightens the environments little light, Orange stimulates physical activity and the respiratory system. Purple (although in small quantities it may have analgesic effects) and red are to be avoided; the latter stimulates nervous and glandular activity, sometimes too much;
• Wide green spaces and use of perspective views of green spaces, accessibility to green spaces in continuity with the interior;
• Limitation of sharp edges and net divisions;
• Limitation of mirrors and reflective surfaces.

From space distribution point of view, the villa Ortisi reuse project places all the functions necessary for the implementation of the most recent rehabilitation protocols. These are places to treat anorexia, bulimia and binge-eating (and the resulting obesity). The project aims to use spaces to prevent different pathologies from hindering each other.

The project foresees:
• the therapeutic residence inside the villa,
• the rehabilitation gym inside the gym,
• the upgrading of the football field,
• the outdoor space as an "extension" of the interior, through the placement of both therapeutic/rehabilitative and recreational activities.

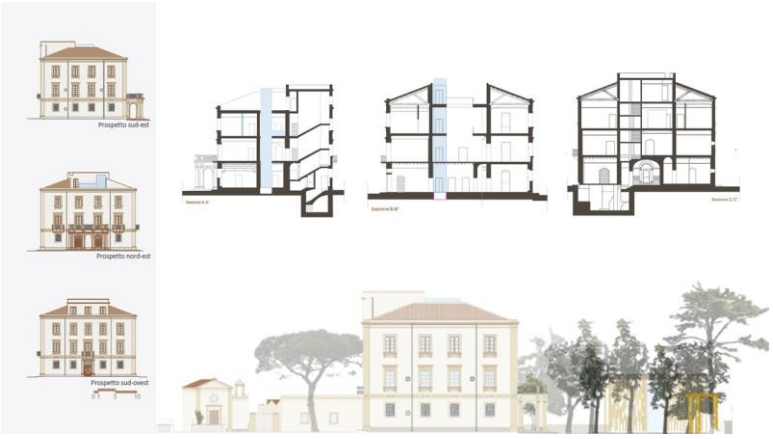

*Figure 6. Project of Villa Ortisi, Syracuse, Sicily, Italy.*

The internal and external modifications respect the constraints imposed by the Italian legislation for historical buildings of cultural interest: The functional distribution follows the consequential course of

the rooms and provides for the installation of a panoramic lift that brings lighter even inside. The project works by levels and according to the neuropsychiatric protocols provided for each pathology.
On the ground floor the project places the outpatient activities (neuropsychiatrist of childhood and adolescence, psychologist-psychotherapist, social worker and dietician), therapeutic and administrative, with spaces for waiting, meeting room, stay for parents-children meeting. The first floor is intended for daytime activities and workshops (music and art workshop, study room, relaxation room, canteen with kitchen workshop). They are designed overlooking the green for each laboratory to give relief to the patient in a moment of inner conflict. The infirmary is strategically located adjacent to the bathrooms of patients. The second floor is intended for inpatient patients. These are double rooms (one is single but can accommodate a pet) customizable, overlooking the green of the surrounding park. The toilet block was placed in the middle of the building for security and control reasons.
On the top floor there is a laundry room adjacent to the roof terrace; in the basement there is an archive.
The project applies the principles of neuroarchitecture using natural materials, such as wood, in order to give patients a more serene, quiet and free of elements that can cause stress, so as to better live the path of care and green to soothe, comfort and feel integrated into the natural system. The neuro-architectural approach suggested to use the green as an extension of the villa with laboratory activities carried out outside and with garden therapy.

*Figure 7. Project views of Villa Ortisi, Syracuse, Sicily, Italy.*

## CONCLUSION

The principles of neuroarchitecture reduce environmental stress and allow patients to maintain a sense of control. In addition, they are real positive distractions that favour, as Dunn said, the well-being of the highest level. They are the observation of works of art, listening to music, the proximity of a pet, watching nature or walking in nature, physical exercise. These principles apply to both the patient and his family and derive from studies on the effectiveness of care.
Despite the potential influence that architecture can give to the psycho-physical well-being of sick people, there has been relatively little commitment from public health to architects.
Joint public-private initiatives could be useful in achieving health realities capable of accommodating and resolving problems related to eating disorders. It is recommended to integrate health into both university and post-university education. Lastly, public health should contribute to building a database of information on health architecture and make it accessible to architectural professions, for example with plain language summaries or infographics, so that it filters effectively in policies and design.

## NOTES

[1] Susan L. Prescott, et al. “Preventive Medicine for Person, Place, and Planet: Revisiting the Concept of High-Level Wellness in the Planetary Health Paradigm,” International Journal of Environmental Research and Public Health 16 no 6 (2019): 238, doi: 10.3390/ijerph16020238.
[2] Ronald Glaser, et al. “Stress-induced immune dysfunction: Implications for health,” Nature Reviews. Immunology 5, no 3 (2005): 243-251, doi: 10.1038/nri1571. Note in Juan Luis Higuera-Trujillo, et al. “The Cognitive-Emotional Design and Study of Architectural Space: A Scoping Review of Neuroarchitecture and Its Precursor Approaches,” Sensors 21, no 6 (2021): 2193, doi: 10.3390/s21062193
[3] Nigel Cross, “Designerly ways of knowing,” Elsevier Design Studies 3, no 4 (1982): 221–227 doi: 10.1016/0142-694X(82)90040-0 in Higuera-Trujillo, et al. 2193.
[4] Esther M. Sternberg, et al. “Neuroscience and Architecture: Seeking Common Ground,” Cell 127, no 2 (2006): 239–242, doi: 10.1016/j.cell.2006.10.012
[5] Juan Luis Higuera-Trujillo, et al. “The Cognitive-Emotional Design and Study of Architectural Space: A Scoping Review of Neuroarchitecture and Its Precursor Approaches,” Sensors 21, no6 (2021): 2193, doi: 10.3390/s21062193
[6] Bernard Dan, “Rehabilitative and Therapeutic Neuroarchitecture,“ Development Medicine & Child Neurology 58, no 11 Editorial (2016): 1098, doi: 10.1111/dmcn.13246
[7] *La mente è meravigliosa*, https://lamenteemeravigliosa.it/neuroarchitettura-ambiente-cervello/ Accessed 2021, march 24.
[8] Lazlo Moholy-Nagy, *Von Material zu Architektur* (Mainz, Germany: Florian Kupferberg, 1929)
[9] Rudolph Arnheim, *Visual thinking* (London: Faber & Faber, 1970)
[10] Richard J. Neutra, *Survival through Design* (New York, NY, USA: Oxford University Press, 1954)
[11] Fred Gage, *Architecture and Neuroscience* (lecture presented at the AIA National Convention, San Diego, California; May 8-10, 2003).
[12] Roger S Ulrich, et al. “A review of the research literature on evidence-based healthcare design”, HERD 1, no 3 (2008): 61-125, doi: 10.1177/193758670800100306
[13] Andréa de Paiva et al. “Short and lond-term effects of architecture on the brain: toward theoretical formalization,” Frontiers of Architectural Research 8, no 4, (2019): 561-571, doi: 10.1016/j.foar.2019.07.004
[14] Nicla Panciera, *Webdolomiti Belluno arte e natura*, https://www.webdolomiti.net/news/venti-minuti-con-la-natura-e-la-psiche-si-trasforma/ (visited 2021, march 24th).
[15] Fred Gage, *Architecture and Neuroscience*, 2003.
[16] Provincial Cadastral Office of Syracuse, Sicily, Italy.
[17] Annalena Guidi, *Giardini di Siracusa dentro e fuori le mura, evoluzione dei giardini urbani e suburbani negli ultimi duecento ann*i, (Siracusa: Zangara stampa, 1986, p.35)

## BIBLIOGRAPHY

Arnheim, Rudolph. *Visual thinking*, London: Faber & Faber, 1970.
Coburn, Alexander Kardan, Omid Kotabe Hiroki, Steinberg Jason, Hout Michael C., Robbins Arryn, MacDonald Justin, Hayn-Leichsenring Gregor, and Berman Marc. “Psychological responses to natural patterns in architecture.” *Journal of Environmental Psychology 62* (2019):133-145, doi: 10.1016/j.jenvp.2019.02.007
Dan, Bernard. *Rehabilitative and Therapeutic neuroarchitecture.* Development Medicine and child neurology. Editorial Mac Keith Press, 2016.
De Benedictis, Emanuele. *Storia di Siracusa*, Scarfì Dario (edited by) Siracusa: Lombardi, 2016.
de Paiva Andréa, and Jedon Richard. “Short and lond-term effects of architecture on the brain: toward theoretical formalization” Frontiers of Architectural Research 8, no 4 (2019) 561-571, doi: 10.1016/j.foar.2019.07.004
Gage, Fred. “Architecture and Neuroscience.” Lecture presented at the AIA National Convention, San Diego, California; May 8-10, 2003.
Ghamari Hessam, Golshany Nasrin, Naghibi R. Parastou, and Bezhadi Farzaneh. “Neuroarchitecture Assessment: An Overview and Bibliometric Analysis,” European journal of investigation in health, psychology and education 11, no 4 (2021): 1362-1387, doi: 10.3390/ejihpe11040099.

Guidi, Annalena. *Giardini di Siracusa dentro e fuori le mura, evoluzione dei giardini urbani e suburbani negli ultimi duecento ann*i, Siracusa: Zangara stampa, 1986.

Hanc, Madalina, McAndrew Claire, and Ucci Marcella. “Conceptual approaches to wellbeing in buildings: a scoping review.” Building Research &. Information 47, no 6 (2019): 767-783, doi: 10.1080/09613218.2018.1513695.

Higuera-Trujillo Juan Luis, Llinares Carmen and Macagno Eduardo. “The Cognitive-Emotional Design and Study of Architectural Space: A Scoping Review of Neuroarchitecture and Its Precursor Approaches.*”* Sensors 21, no 6, (2021), doi: 10.3390/s21062193

Kim, Sanghee, Park Hyejin, Choo Seungyeon. “Effects of Changes to Architectural Elements on Human Relaxation-Arousal Responses: Based on VR and EEG.” International Journal of Environmental Research and Public Health 18, no 8 (2021), doi: 10.3390/ijerph18084305.

*La* mente *è meravigliosa*, https://lamenteemeravigliosa.it/neuroarchitettura-ambiente-cervello/ (visited 2021, march 24th).

Llorens-Gámez Mar, Higuera-Trujillo Juan Luis, Sentieri Omarrementeria, Carla, Llinares Carmen. “The impact of the design of learning spaces on attention and memory from a neuroarchitectural approach: A systematic review.” Frontiers of architectural research 11, no 3 (2022): 542-560, doi: 10.1016/j.foar.2021.12.002

Moholy-Nagy, Lazlo. *Von Material zu Architektur*; Mainz, Germany: Florian Kupferberg, 1929.

Neutra, Richard J. *Survival through Design*; New York, NY, USA: Oxford University Press, 1954.

Panciera, Nicla. *Webdolomiti Belluno arte e natura*, https://www.webdolomiti.net/news/venti-minuti-con-la-natura-e-la-psiche-si-trasforma/ Accessed 2021, march 24.

Prescott, Susan L., Logan Alan C., and Katz David L. “Preventive Medicine for Person, Place, and Planet: Revisiting the Concept of High-Level Wellness in the Planetary Health Paradigm.*”* International Journal of Environmental Research and Public Health 16, no 2 (2019): 238, doi: 10.3390/ijerph16020238

Shemesh, Avishag, Leisman Gerry, Bar Moshe, and Grobman Yasha Jacob. “A neurocognitive study of the emotional impact of geometrical criteria of architectural space.” Architectural Science Review 64, no 4 (2021): 394-407, doi: 10.1080/00038628.2021.1940827.

Sternberg, Esther M., Wilson Matthew A. “Neuroscience and Architecture: Seeking Common Ground.” Cell 127, no2 (2006): 239-242, doi: 10.1016/j.cell.2006.10.012.

Ulrich, Roger S, Zimring Craig, Zhu Xuemei, DuBose Jennifer, Seo Hyun-Bo, Choi Young-Seon, Quan Xiaobo, and Joseph Anjali. “A review of the research literature on evidence-based healthcare design.” HERD 1, no 3, (2008): 61-125, doi: 10.1177/193758670800100306.

Zhang, Yufan, Tzortzopoulos Patricia, Kagioglou Mike. “Healing built-environment effects on health outcomes: environment–occupant–health framework.” Building Research & Information 47, no 6 (2019): 747-766, doi: 10.1080/09613218.2017.1411130.

Zisch, Fiona, “Wicked Neuroarchitecture: Reciprocity, Shapeshifting Problems and a Case for Embodied Knowledge.” Architectural design 90, no 6 (2020): 118-127, doi: 10.1002/ad.2640.

# IMPACTS OF BUILT ENVIRONMENT CHARACTERISTICS ON TRAVEL SATISFACTION AND SUBJECTIVE WELL-BEING DURING THE COVID-19 PANDEMIC IN GREATER MONTREAL, CANADA

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## INTRODUCTION

Over the past 18 months, the COVID-19 pandemic has profoundly changed people's lives and will assuredly have long-term effects on their habits, health, and well-being. At the beginning of the pandemic, the stay-at-home orders forced people to spend more time at home and in their immediate neighbourhoods than ever before, which in turn made them interact with their built environment in new ways. The pandemic also shed light on pre-existing problems regarding equity and accessibility to quality activities, by active modes in particular. The objective of this study is to better understand how the built environment impacted Montrealers' travel experience and well-being over the course of the pandemic thus far. This research is based on data from three surveys launched over the course of the pandemic, the first in May 2020 and the second and third in the fall of 2021, and supplemented by built environment data, allowing the exploration of how Montrealers travel and how their immediate neighbourhoods and perceptions of it impact their travel satisfaction and well-being. These initial findings give insight into the built environment's role in promoting health and well-being, as well as into what local built-environment initiatives might be beneficial going forward.

## LITERATURE REVIEW

This brief literature review on travel satisfaction and its relationship with life satisfaction and people's environments provides context to the study and demonstrates the importance of exploring the impact of the built environment on subjective well-being, especially in the current context. In the literature, there has been extensive research done on the impact of the built environment on travel behaviour and to a lesser extent, on trip satisfaction and life satisfaction or well-being. It has been shown that people's perceptions of their environment have a larger impact on their travel behaviour than objective measures. People therefore experience their environments differently and the same features of an environment will have different impacts on different people. We also know that travel affects people's well-being, and people consider travel satisfaction as they rate their general life satisfaction. However, there remains some ambiguity in how well-being is defined[1] and how the data is analyzed. Travel can affect well-being in many ways[2], whether it be during the trip itself (e.g., how comfortable people feel travelling), in its ability to get people to their desired destinations (e.g., access) or even the potential to travel (e.g., having the option to travel if they needed to[3]). It's also important to note that

how people get around, for example what mode they use, might not be how they would wish to, which could impact their travel and life satisfaction.[4,5] During the first wave of the pandemic, where the incidence of trips to simply get out rose to unprecedented levels, people might have used new (or infrequently used) travel modes.[6,7] The context changes and even the changes in people's priorities during this time could bring about opportunities to study the emergence of new travel behaviours and habits.[8] Further, this repeated study allows us to examine the effects over time such as whether people maintain their new travel habits post-pandemic.[9]

## METHODOLOGY

### Geographical Context

The area concerned by this study is Greater Montreal, a metropolitan city in southern Quebec, Canada. The Greater Montreal region has a population of more than four million residents spread over an area of 4,360 $km^2$. In comparison to many North American cities, it has a well-used and developed public transit system, consisting of bus lines, a metro system, and a suburban train network. However, the ridership has fallen quite significantly over the course of the pandemic[10,11] due to government stay-at-home orders, but also likely linked to worries related to being in confined spaces with various other residents.[12,13]

Within Canada, the province of Quebec was hard-hit by the pandemic, with some of the highest number and rates per one hundred thousand of cases throughout the pandemic.[14] By the end of March 2020, all non-essential businesses were closed in Quebec and lockdown and social distancing measures were put into place to attempt to quell the rising number of cases.[15] Moreover, Canadians, especially young Canadians, reported a worsening in their mental health and higher levels of stress[16,17], which was linked to sedentary activities.[18] Fourteen months into the pandemic, the summer of 2021 saw a loosening of the restrictions, though Quebecers were strongly encouraged to get fully vaccinated before the fall. Daily life was becoming more normal, students going back to school in person and more companies allowing their employees to return in person, though travel rates were still lower than pre-pandemic levels, especially by public transit.[19]

### Surveys

The data collected for the study stems from three stated-preference surveys, launched in May 2020, September 2021 and October 2021. Data was gathered on how Montrealers travel, their perceptions of their immediate neighbourhoods, as well as subjective measures of their travel satisfaction and well-being. All three questionnaires were fundamentally the same, though certain revisions were made to each so as to reflect the changing conditions and relevant policy questions.

The first survey, launched in May 2020, approximately six weeks after the social distancing and lockdown measures were instituted in Montreal, sought to give insight into the impact of the pandemic on respondents' travel and social interactions as well as the impact on children, the last part of the survey encouraging parents to answer questions about their children's travel and social habits. This first survey was launched nationwide, as well as in China and the United States, where the response rate in these countries was much lower. The survey was promoted by two local universities (Polytechnique Montréal and McGill University) along with local media (CBC radio, Radio-Canada).

The second survey, launched in September 2021, focused only on the Greater Montreal area, and a marketing firm was used to ensure a more representative sample of Montreal's population among the respondents. The survey was shorter, questions about social interactions and children reduced or removed and questions about travel and the respondents' immediate neighbourhood added.

The purpose of the third survey, launched in October 2021, was to target cyclists, who were underrepresented in the September survey. The September and October surveys are combined for the purposes of this study and the results will focus mainly on that data.

### Objective Neighbourhood Data

In order to study whether there is a dissonance between people's perceptions of the neighbourhood features and objective measures of said features, this data, taken from various open sources, was analyzed using QGIS (Geographical Information System). The importance of microfeatures[20,21] cannot be understated in people's evaluation of their travel satisfaction, especially for trips by bike or by foot, and for the purposes of this initial analysis of the data, the features that were retained were local parks and sidewalks. It is to be noted that due to limitations with the data, the neighbourhood data is only available for respondents on the island of Montreal, and not for the Greater Montreal area. The respondents outside of the island will therefore be excluded for this third part of the analysis.

### Descriptive Analysis

In order to understand the impacts of the pandemic and the built environment on Montrealers, the relationships between satisfaction, built environment, perceptions were analyzed using descriptive statistics. To understand how these relationships may vary between groups, respondents were categorized in three ways. Firstly, they were asked what mode they used for trips that's purpose was more of utilitarian nature and if more than 40% of these trips were by car, by foot, or by bike, they were classified accordingly. There were not enough users of public transit to include that mode category in this study.

The second classification is based on a question from the survey asking how frequently the respondent walked in their neighbourhood at the time of the survey, ranging from never to almost every day. This accounts for trips that are not of utilitarian purpose, such as walks to simply get out. The assumption is made that such trips are mostly carried out in people's immediate environments.

Finally, respondents were classified based on their home location. To do so, the survey data was combined with objective measures of the built environment taken from open data sources curated by the City of Montreal for the respondents who willingly provided their postal code. The open data available is limited to the island of Montreal and includes parks and average sidewalk width in a buffer of eight hundred meters around people's residence, as recommended by the literature.[22]

In this paper, the tool developed by Ettema et al.[23] to evaluate trip satisfaction and subjective well-being was used when asking the survey respondents to evaluate their satisfaction with their last trip. The respondents were asked to rate their general life and trip satisfaction on seven-point Likert scales.

Figure 1 presents the home location of respondents together with the population density. The higher density areas are concentrated in the center of the city, on the island of Montreal, whereas the lower density areas extend into the peripheries. The respondents were classified according to the density of their census tract, or subdivisions if outside the census tract area.


*Figure 1. Respondents' home locations and the population density of their census tract or subdivision*

Following this classification, the results will be presented in three parts, firstly with life and travel satisfaction results, then how people get around their neighbourhood, and finally comparing people's perceptions of their environment with objective measures of their neighbourhood features.

## RESULTS AND DISCUSSION

### Life and Travel Satisfaction

Firstly, people's evaluation of their life satisfaction before COVID is found to be quite high for all densities and across both time periods, which is congruent with previous data, noting that Canadians tend to rate their life satisfaction very highly.[24]

Looking at their life satisfaction at the time that they answered the survey in Figure 2, May 2020 and Fall 2021 respectively, COVID seems to have impacted people's ratings of their life satisfaction strongly. In May 2020, the rating was low across all densities, though people living in lower density areas seem to have been slightly more satisfied with their lives. In the fall of 2021, 18 months into the pandemic, levels have improved and there is less of a remarkable difference between the densities.

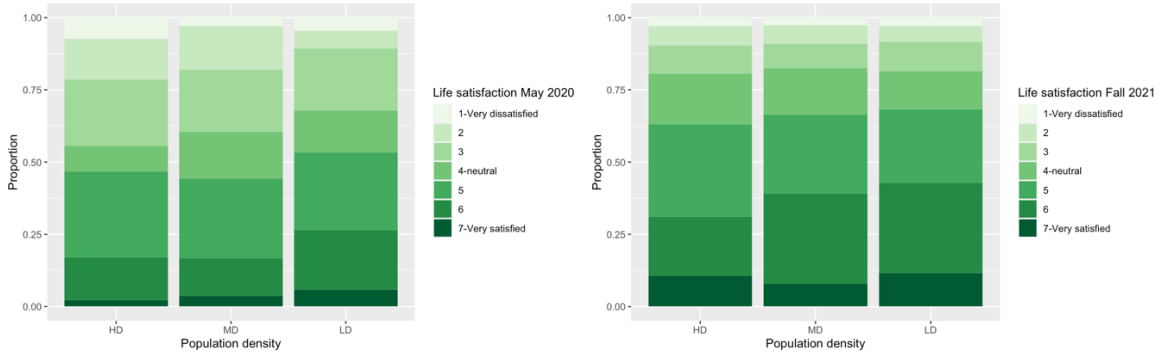


*Figure 2. Respondents' life satisfaction in May 2020 and Fall 2021 (NA excluded)*

Looking at how respondents rated their general travel satisfaction in Figure 3, it follows a similar trend. In May 2020, travel satisfaction was still for the most part positive (5 to 7), though a little lower for high and medium density areas, which could be explained by travel being more stressful for people living in higher density areas, due to concerns related to how the virus spread. Travel satisfaction has increased for residents in the denser areas in fall of 2021 to the point that there is little observable difference between the densities

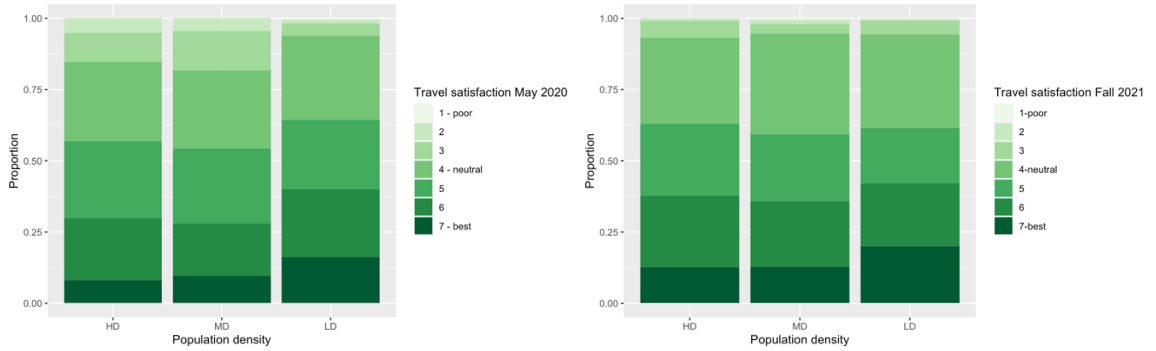


*Figure 3. Respondents' travel satisfaction in May 2020 and Fall 2021 (NA excluded)*

Looking at travel satisfaction according to the type of traveler in Figure 4, drivers are the most numerous and seem to be the most satisfied, though pedestrians rate their travel satisfaction high as well.

Looking at travel satisfaction based on how frequently people say they walk around their neighbourhood in Figure 4, travel satisfaction seems to increase with the frequency of walking. This trend is especially evident in low density areas. People in these areas who walk frequently appear to really enjoy walking and rate their general satisfaction higher.[25]

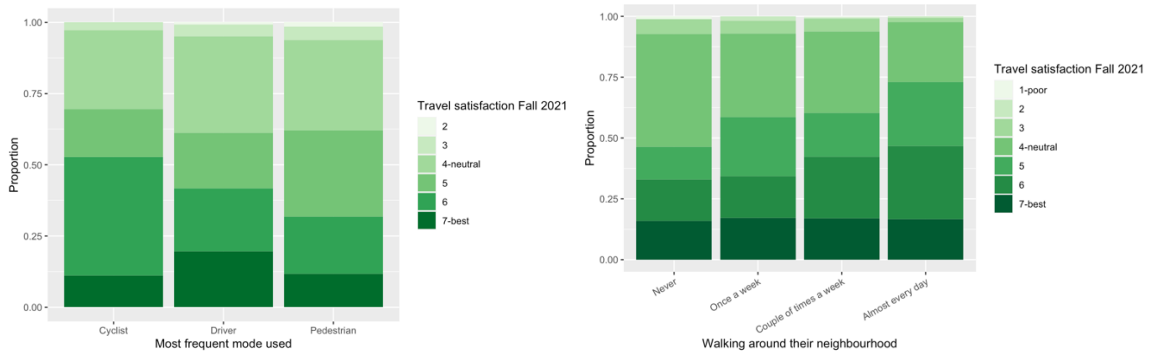


*Figure 4. Respondents' travel satisfaction in Fall 2021 according to their most frequent mode (NA excluded) and how frequently they walk around their neighbourhood (NA excluded)*

## How Respondents Get Around their Neighbourhood

The data shows that distinct differences can be seen when looking at how people would like to get around in their neighbourhood post-COVID. Figure 5 shows that people in high and medium densities would prefer to get around by walking, while in low density areas, walking and driving are equally popular. A similar trend to walking is observed for cycling, which increases in popularity with population density. This may stem from respondents being satisfied with the way they get around their neighbourhoods, or from the way in which they perceive their environment. People in lower density areas might feel that a car is necessary to get around. Further exploration of these answers will be necessary to better understand what might explain these outcomes.

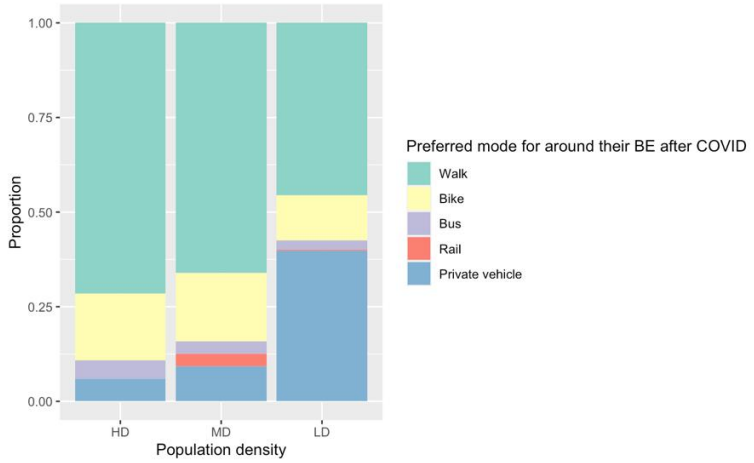


*Figure 5. What mode respondents would prefer to use to get around their neighbourhood after COVID according to population density (NA excluded)*

The following results are related to four specific questions that were asked on perceived accessibility. They stem from a framework developed by Lättman et al.[26], who sought to understand the role of perceived accessibility in satisfaction with travel and life. Firstly, the respondents were asked their level of agreement with "Considering how I travel now (these days) it is easy to do my daily activities". Drivers in medium and low-density areas agreed more strongly with the statement (47% and 43% respectively) than the pedestrians (25% and 35%) and cyclists (24% and 33%), whereas in higher density areas, the pedestrians agreed the most strongly (41% versus 33% for drivers). Then, survey participants were asked "Considering how I travel now (these days) I am able to live my life as I want to". In all densities the responses were high, especially for drivers, congruent with the high level of travel and life satisfaction amongst the respondents. Thirdly, they were asked "Considering how I travel now (these days) I am able to do all activities I prefer", which again was strongly agreed with by all respondents. Pedestrians in high-density areas that agreed very strongly with this statement (25%) constitute a larger proportion of the respondents than pedestrians who strongly agreed in medium and low-density areas (13% and 15%). Finally, they were asked "Access to my preferred activities is satisfying considering how I travel now (these days)", which is agreed with strongly by drivers in all densities and by pedestrians in high density areas (26%).

## Perceptions and Objectives Measures of Respondents' Neighbourhoods

Stemming from specific questions that were asked of the respondents on the surveys, the findings indicate that residents of Greater Montreal across all density areas are satisfied with the space that is provided in their local parks. The question is specifically related to the COVID context since it was asked if their parks allowed social distancing. The perception of having grocery stores and shops in their neighbourhood they can walk to increases with density, as does having destinations of interest they can walk to, which matches previous studies.[27] From the previous results, Montreal residents seem to believe that amenities in lower density areas are not easily accessible on foot.

In this case, the respondents' perception of the widths of the sidewalks in their neighbourhood is heavily influenced by the pandemic. We can see from Figure 6 that in May 2020, Montrealers across the density areas were very dissatisfied with the width of their local sidewalks, likely related to uncertainty surrounding the level of contagion of the virus. For fall 2021, their agreement has increased significantly and increases with density, people in higher density areas being the most in agreement with their sidewalks being wide enough for pedestrians to safely pass each other.

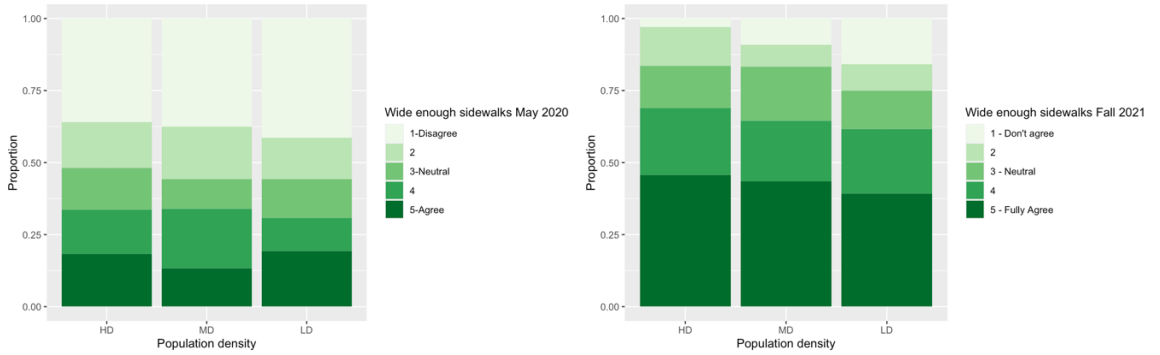


*Figure 6. Respondents' perception of the sidewalk width in their neighbourhood in May 2020 and Fall 2021 (NA excluded)*

Looking at the objective measures of the neighbourhood features, the objective measure of the area of the respondent's nearest park is in line with the perceptions. Previously, we saw that respondents were satisfied with the space provided by their local parks, and that the agreement is corroborated with objective values: people not agreeing with the statement have objectively smaller parks than those who do.

On average, pedestrians (1.9 m to 3.1 m) and cyclists (1.8 m to 2.8 m) have wider sidewalks in their neighbourhoods than drivers (0.9 m to 2.5 m). Looking more closely at how respondents rate the sidewalk widths, for drivers, the average sidewalk width does not match with their perceptions (1.8 m for drivers who don't agree versus 1.9 m who strongly agree, with little variation). This could indicate that frequent drivers' perceptions, being less frequent users of the pedestrian infrastructure, do not reflect reality.

Looking at how frequently respondents walk in their neighbourhood versus the average sidewalk width in their immediate environment, Figure 7 shows distinct trends. Firstly, average sidewalk width increases with population density and with the frequency of walking in their neighbourhood. It could be concluded here that the more people walk in their neighbourhood, for all densities, the more their perception of sidewalk width is accurate.

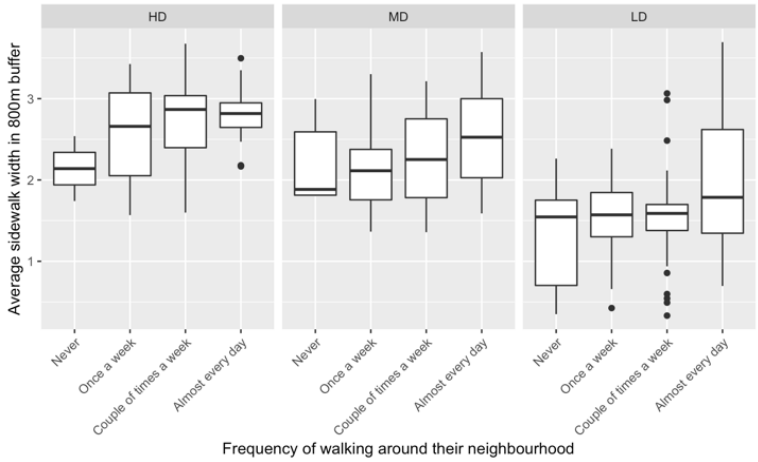


*Figure 7. Average sidewalk width in 800 m buffer from respondents' home location according to how frequently they walk in their neighbourhood (NA excluded)*

## CONCLUSION

To conclude, in this exploratory analysis of the survey data, the impact that COVID had on Montrealers' perceptions of their neighbourhood as well as its impact of their subjective well-being and travel satisfaction was explored. The principal results indicate that the pandemic has had an important impact on Montrealers' life and travel satisfaction, and on their perceptions of their neighbourhoods. People in higher density neighbourhoods would like to use active travel modes to get around their neighbourhood after the pandemic, whereas people in lower density neighbourhoods seem to favour both walking and driving. Moreover, though people found the width of the sidewalks in their neighbourhoods to be inadequate at the beginning of the pandemic, this perception has improved, 18 months later, especially for higher density areas. Future research will examine more precise features of the built environment that will then be included in analyses of people's travel and life satisfaction. The results of this study help to better understand how the built environment impacted Montrealers' travel experience and well-being over the course of the pandemic thus far, giving insight into what local built-environment initiatives might be beneficial going forward. It can also help understand how to promote active transport modes in different environment and tailor policies to people's tastes, perceptions and local environment.

## ACKNOWLEDGEMENTS

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## NOTES

[1] Rachel Dodge et al., "The challenge of defining wellbeing," International Journal of Wellbeing 2 (2012), https://doi.org/10.5502/ijw.v2i3.4.
[2] Edward Owen D. Waygood et al., "Transport and child well-being: An integrative review," *Travel Behaviour and Society* 9 (2017), https://doi.org/10.1016/j.tbs.2017.04.005.
[3] Katrin Lättman et al., "Perceived Accessibility, Satisfaction with Daily Travel, and Life Satisfaction among the Elderly," International Journal of Environmental Research and Public Health 16 (2019), https://doi.org/10.3390/ijerph16224498.
[4] Jonas De Vos et al., "Travel and Subjective Well-Being: A Focus on Findings, Methods and Future Research Needs," Transport Reviews 33, no. 4 (2013), https://doi.org/10.1080/01441647.2013.815665.
[5] Jonas De Vos, "Do people travel with their preferred travel mode? Analysing the extent of travel mode dissonance and its effect on travel satisfaction," Transportation Research Part A: Policy and Practice 117 (2018), https://doi.org/10.1016/j.tra.2018.08.034.
[6] Jonas De Vos, "The effect of COVID-19 and subsequent social distancing on travel behavior," Transportation Research Interdisciplinary Perspectives 5 (2020), https://doi.org/10.1016/j.trip.2020.100121.
[7] Dick Ettema et al., "Satisfaction with travel and subjective well-being: Development and test of a measurement tool," Transportation Research Part F: Traffic Psychology and Behaviour 14, no. 3 (2011), https://doi.org/10.1016/j.trf.2010.11.002.
[8] De Vos, "The effect of COVID-19 and subsequent social distancing on travel behavior."
[9] Paul Haggar, Lorraine Whitmarsh, and Stephen M. Skippon, "Habit discontinuity and student travel mode choice," Transportation Research Part F: Traffic Psychology and Behaviour 64 (2019), https://doi.org/10.1016/j.trf.2019.04.022.
[10] Nick. Boisvert, "TTC facing $92M monthly shortfall, plummeting ridership due to COVID-19," CBC 2020, https://www.cbc.ca/news/canada/toronto/ttc-finances-covid19-1.5569867.
[11] Société de transport de Montréal, "STM presents its 2020 Annual Report a year filled with challenges," news release, 2021, https://www.stm.info/fr/presse/communiques/2021/la-stm-presente-son-rapport-d-activite-2020-marque-par-de-nombreux-defis.
[12] Bogdan Kapatsila and Emily Grise, "Public Transit Riders' Perceptions and Experience of Safety: COVID-19 Lessons from Edmonton," Findings (2021), https://doi.org/10.32866/001c.19046.
[13] M. Harris and Michael Branion-Calles, "Changes in Commute Mode Attributed to COVID-19 Risk in Canadian National Survey Data," Transport Findings (2021), https://doi.org/10.32866/001c.19088.
[14] "COVID-19 Intervention Timeline in Canada," 2021, accessed January 20, 2022, https://www.cihi.ca/en/covid-19-intervention-timeline-in-canada.
[15] "COVID-19: Emergency Measures Tracker," 2021, accessed October 23, 2021, https://www.mccarthy.ca/en/insights/articles/covid-19-emergency-measures-tracker
[16] "Canadians' mental health during the COVID-19 pandemic," The Daily, 2020, accessed January 20, 2022, https://www150.statcan.gc.ca/n1/daily-quotidien/200527/dq200527b-eng.htm.
[17] "Canadian Perspectives Survey Series 2: Monitoring the effects of COVID-19, May 2020," The Daily, 2020, accessed January 20, 2022, https://www150.statcan.gc.ca/n1/daily-quotidien/200604/dq200604b-eng.htm.
[18] Raktim Mitra, E. Owen D. Waygood, and Josh Fullan, "Subjective well-being of Canadian children and youth during the COVID-19 pandemic: The role of the social and physical environment and healthy movement behaviours," Preventive Medicine Reports 23 (2021), https://doi.org/10.1016/j.pmedr.2021.101404.
[19] Zacharie Goudreault, "La STM demeurera réduite en 2022 en raison de la pandémie," Le Devoir 2021, https://www.ledevoir.com/societe/transports-urbanisme/656526/la-pandemie-affectera-encore-le-service-de-la-stm-en-2022.
[20] Barbara Brown et al., "Walkable Route Perceptions and Physical Features Converging Evidence for En Route Walking Experiences," Environment and Behavior 39 (2007), https://doi.org/10.1177/0013916506295569.
[21] Robert Cervero and Michael Duncan, "Walking, Bicycling, and Urban Landscapes: Evidence From the San Francisco Bay Area," American journal of public health 93 (2003), https://doi.org/10.2105/AJPH.93.9.1478.
[22] Alistair Sherret, Peat, Marwick, Mitchell & Co., United States Department of Transportation, and United States Department of Housing and Urban Development., *BART's first five years : transportation and travel impacts* (Washington : Dept. of Transportation, 1979).
[23] Ettema et al., "Satisfaction with travel and subjective well-being: Development and test of a measurement tool."
[24] "Life Satisfaction in Canada Before and During the COVID-19 Pandemic," Statistics Canada, 2020, accessed January 20, 2022, https://www150.statcan.gc.ca/n1/pub/11f0019m/11f0019m2020020-eng.htm.

[25] Jonas De Vos and Frank Witlox, "Do people live in urban neighbourhoods because they do not like to travel? Analysing an alternative residential self-selection hypothesis," Travel Behaviour and Society 4 (2016), https://doi.org/10.1016/j.tbs.2015.12.002.
[26] Lättman et al., "Perceived Accessibility, Satisfaction with Daily Travel, and Life Satisfaction among the Elderly."
[27] Barbara Brown et al., "Walkable Route Perceptions and Physical Features Converging Evidence for En Route Walking Experiences," Environment and Behavior 39 (2007), https://doi.org/10.1177/0013916506295569.

## BIBLIOGRAPHY


Altomonte, Sergio, Joseph Allen, Philo Bluyssen, Gail Brager, Lisa Heschong, Angela Loder, Jennifer Veitch, Lily Wang, and Pawel Wargocki. "Ten Questions Concerning Well-Being in the Built Environment." Building and Environment 180 (2020): 106949. https://doi.org/10.1016/j.buildenv.2020.106949.

Anable, Jillian, and Birgitta Gatersleben. "All Work and No Play? The Role of Instrumental and Affective Factors in Work and Leisure Journeys by Different Travel Modes." Transportation Research Part A: Policy and Practice 39, no. 2 (2005): 163-81. https://doi.org/https://doi.org/10.1016/j.tra.2004.09.008.

Avila-Palencia, Ione, Luc Int Panis, Evi Dons, Mailin Gaupp-Berghausen, Elisabeth Raser, Thomas Götschi, Regine Gerike*, et al.* "The Effects of Transport Mode Use on Self-Perceived Health, Mental Health, and Social Contact Measures: A Cross-Sectional and Longitudinal Study." Environment International 120 (2018): 199-206. https://doi.org/10.1016/j.envint.2018.08.002.

Boisvert, Nick. "Ttc Facing $92m Monthly Shortfall, Plummeting Ridership Due to Covid-19." CBC, 2020. https://www.cbc.ca/news/canada/toronto/ttc-finances-covid19-1.5569867.

Brown, Barbara, Carol Werner, Jonathan Amburgey, Jonathan Gallimore, and Caitlin Szalay. "Walkable Route Perceptions and Physical Features Converging Evidence for En Route Walking Experiences." Environment and Behavior 39 (2007): 34-61. https://doi.org/10.1177/0013916506295569.

"Covid-19 Intervention Timeline in Canada." 2021, accessed January 20, 2022, https://www.cihi.ca/en/covid-19-intervention-timeline-in-canada.

Cervero, Robert, and Michael Duncan. "Walking, Bicycling, and Urban Landscapes: Evidence from the San Francisco Bay Area." American journal of public health 93 (2003): 1478-83. https://doi.org/10.2105/AJPH.93.9.1478.

De Vos, Jonas. "Do People Travel with Their Preferred Travel Mode? Analysing the Extent of Travel Mode Dissonance and Its Effect on Travel Satisfaction." Transportation Research Part A: Policy and Practice 117 (2018): 261-74. https://doi.org/10.1016/j.tra.2018.08.034.

———. "The Effect of Covid-19 and Subsequent Social Distancing on Travel Behavior." Transportation Research Interdisciplinary Perspectives 5 (2020). https://doi.org/10.1016/j.trip.2020.100121.

De Vos, Jonas, Tim Schwanen, Veronique Van Acker, and Frank Witlox. "Travel and Subjective Well-Being: A Focus on Findings, Methods and Future Research Needs." Transport Reviews 33, no. 4 (2013): 421-42. https://doi.org/10.1080/01441647.2013.815665.

De Vos, Jonas, and Frank Witlox. "Do People Live in Urban Neighbourhoods Because They Do Not Like to Travel? Analysing an Alternative Residential Self-Selection Hypothesis." Travel Behaviour and Society 4 (2016): 29-39. https://doi.org/10.1016/j.tbs.2015.12.002.

Delbosc, Alexa, and Graham Currie. "Exploring the Relative Influences of Transport Disadvantage and Social Exclusion on Well-Being." Transport Policy 18, no. 4 (2011): 555-62. https://doi.org/10.1016/j.tranpol.2011.01.011.

Dodge, Rachel, Annette P. Daly, Jan Louise Huyton, and Lalage Sanders. "The Challenge of Defining Wellbeing." International Journal of Wellbeing 2 (2012): 222-35. https://doi.org/10.5502/ijw.v2i3.4.

Ettema, Dick, Tommy Gärling, Lars Eriksson, Margareta Friman, Lars E. Olsson, and Satoshi Fujii. "Satisfaction with Travel and Subjective Well-Being: Development and Test of a Measurement Tool." Transportation Research Part F: Traffic Psychology and Behaviour 14, no. 3 (2011): 167-75. https://doi.org/10.1016/j.trf.2010.11.002.

Gee, Gilbert, Yingling Fan, and David Takeuchi. "Do Physical Neighborhood Characteristics Matter in Predicting Traffic Stress and Health Outcomes." Transportation Research Part F: Traffic Psychology and Behaviour 10 (2007): 164-76. https://doi.org/10.1016/j.trf.2006.09.001.

Goudreault, Zacharie. "La Stm Demeurera Réduite En 2022 En Raison De La Pandémie." Le Devoir, 2021. https://www.ledevoir.com/societe/transports-urbanisme/656526/la-pandemie-affectera-encore-le-service-de-la-stm-en-2022.

Grabow, Maggie, Milena Bernardinello, Andrew Bersch, Corinne Engelman, Ana Martinez-Donate, Jonathan Patz, Paul Peppard, and Kristen Malecki. "What Moves Us: Subjective and Objective Predictors of Active Transportation." Journal of Transport & Health 15 (2019): 100625. https://doi.org/10.1016/j.jth.2019.100625.

Haggar, Paul, Lorraine Whitmarsh, and Stephen M. Skippon. "Habit Discontinuity and Student Travel Mode Choice." Transportation Research Part F: Traffic Psychology and Behaviour 64 (2019): 1-13. https://doi.org/10.1016/j.trf.2019.04.022.

Handy, Susan L., Marlon G. Boarnet, Reid Ewing, and Richard E. Killingsworth. "How the Built Environment Affects Physical Activity: Views from Urban Planning." American Journal of Preventive Medicine 23, no. 2, Supplement 1 (2002): 64-73. https://doi.org/https://doi.org/10.1016/S0749-3797(02)00475-0.

Harris, M., and Michael Branion-Calles. "Changes in Commute Mode Attributed to Covid-19 Risk in Canadian National Survey Data." Transport Findings (2021). https://doi.org/10.32866/001c.19088.

Hatamzadeh, Yaser, Meeghat Habibian, and Ali Khodaii. "Measuring Walking Behaviour in Commuting to Work: Investigating the Role of Subjective, Environmental and Socioeconomic Factors in a Structural Model." International Journal of Urban Sciences 24, no. 2 (2020): 173-88. https://doi.org/10.1080/12265934.2019.1661273.

Haybatollahi, Sayyed M., Michał Czepkiewicz, Tiina Rinne, and Marketta Kyttä. "Neighbourhood Preferences, Active Travel Behaviour, and Built Environment: An Exploratory Study." Transportation Research Part F Traffic Psychology and Behaviour 29 (2015): 57-69. https://doi.org/10.1016/j.trf.2015.01.001.

"Life Satisfaction in Canada before and During the Covid-19 Pandemic." Statistics Canada, 2020, accessed January 20, 2022, https://www150.statcan.gc.ca/n1/pub/11f0019m/11f0019m2020020-eng.htm.

Helliwell, John, and Robert Putnam. "The Social Context of Well-Being." Philosophical transactions of the Royal Society of London. Series B, Biological sciences 359 (2004): 1435-46. https://doi.org/10.1098/rstb.2004.1522.

Herrmann, Thomas, Geneviève Boisjoly, Nancy Ross, and Ahmed El-Geneidy. "The Missing Middle: Filling the Gap between Walkability and Observed Walking Behavior." Transportation Research Record: Journal of the Transportation Research Board 2661 (2017): 103-10. https://doi.org/10.3141/2661-12.

Hilbrecht, Margo, Bryan Smale, and Steven E. Mock. "Highway to Health? Commute Time and Well-Being among Canadian Adults." World Leisure Journal 56, no. 2 (2014): 151-63. https://doi.org/10.1080/16078055.2014.903723.

Kamruzzaman, Md, Farjana Shatu, Julian Hine, and Gavin Turrell. "Commuting Mode Choice in Transit Oriented Development: Disentangling the Effects of Competitive Neighbourhoods, Travel Attitudes, and Self-Selection." Transport Policy 42 (2015): 187-96. https://doi.org/10.1016/j.tranpol.2015.06.003.

Kang, Chang-Deok. "Measuring the Effects of Street Network Configurations on Walking in Seoul, Korea." Cities 71 (2017): 30-40. https://doi.org/https://doi.org/10.1016/j.cities.2017.07.005.

Kapatsila, Bogdan, and Emily Grise. "Public Transit Riders' Perceptions and Experience of Safety: Covid-19 Lessons from Edmonton." Findings (2021). https://doi.org/10.32866/001c.19046.

Katrakazas, Christos, Eva Michelaraki, Marios Sekadakis, and George Yannis. "A Descriptive Analysis of the Effect of the Covid-19 Pandemic on Driving Behavior and Road Safety." Transportation Research Interdisciplinary Perspectives 7 (2020): 100186. https://doi.org/https://doi.org/10.1016/j.trip.2020.100186.

Khaddar, Shivam, and Mahmudur Rahman Fatmi. "Covid-19: Are You Satisfied with Traveling During the Pandemic?". Transportation Research Interdisciplinary Perspectives 9 (2021): 100292. https://doi.org/https://doi.org/10.1016/j.trip.2020.100292.

Koohsari, Javad, Neville Owen, Rachel Cole, Suzanne Mavoa, Koichiro Oka, Tomoya Hanibuchi, and Takemi Sugiyama. "Built Environmental Factors and Adults' Travel Behaviors: Role of Street Layout and Local Destinations." Preventive Medicine 96 (2016). https://doi.org/10.1016/j.ypmed.2016.12.021.

Lättman, Katrin, Lars Olsson, Margareta Friman, and Satoshi Fujii. "Perceived Accessibility, Satisfaction with Daily Travel, and Life Satisfaction among the Elderly." International Journal of Environmental Research and Public Health 16 (2019): 4498. https://doi.org/10.3390/ijerph16224498.

Li, Jingjing, Changjoo Kim, and Sunhee Sang. "Exploring Impacts of Land Use Characteristics in Residential Neighborhood and Activity Space on Non-Work Travel Behaviors." Journal of Transport Geography 70 (2018): 141-47. https://doi.org/10.1016/j.jtrangeo.2018.06.001.

Lu, Yi, Yang Xiao, and Yu Ye. "Urban Density, Diversity and Design: Is More Always Better for Walking? A Study from Hong Kong." Preventive medicine 103S (2016). https://doi.org/10.1016/j.ypmed.2016.08.042.

Luo, Jian Ming, and Chi Lam. "Travel Anxiety, Risk Attitude and Travel Intentions Towards "Travel Bubble" Destinations in Hong Kong: Effect of the Fear of Covid-19." International Journal of Environmental Research and Public Health 17 (2020). https://doi.org/10.3390/ijerph17217859.

Ma, Liang, and Jennifer Dill. "Associations between the Objective and Perceived Built Environment and Bicycling for Transportation." Journal of Transport & Health 2 (2015). https://doi.org/10.1016/j.jth.2015.03.002.

Manaugh, Kevin, and Ahmed M. El-Geneidy. "Does Distance Matter? Exploring the Links among Values, Motivations, Home Location, and Satisfaction in Walking Trips." Transportation Research Part A: Policy and Practice 50 (2013): 198-208. https://doi.org/10.1016/j.tra.2013.01.044.

"Covid-19: Emergency Measures Tracker." 2021, accessed October 23, 2021, https://www.mccarthy.ca/en/insights/articles/covid-19-emergency-measures-tracker

Mitra, Raktim, E. Owen D. Waygood, and Josh Fullan. "Subjective Well-Being of Canadian Children and Youth During the Covid-19 Pandemic: The Role of the Social and Physical Environment and Healthy Movement Behaviours." Preventive Medicine Reports 23 (2021): 101404. https://doi.org/10.1016/j.pmedr.2021.101404.

Mohiuddin, Hossain, Shaila Jamal, and Antonio Páez. "How Do the Perceptions of Neighborhood Conditions Impact Active Transportation? A Study in Rajshahi, Bangladesh." Transportation Research Part D Transport and Environment 87 (2020). https://doi.org/10.1016/j.trd.2020.102525.

Mokhtarian, Patricia L. "Subjective Well-Being and Travel: Retrospect and Prospect." Transportation 46, no. 2 (2019): 493-513. https://doi.org/10.1007/s11116-018-9935-y.

Olsson, Lars, Tommy Gärling, Dick Ettema, Margareta Friman, and Satoshi Fujii. "Happiness and Satisfaction with Work Commute." Social indicators research 111 (2013): 255-63. https://doi.org/10.1007/s11205-012-0003-2.

Pasanen, Tytti, Mathew White, Benedict Wheeler, Jo Garrett, and Lewis Elliott. "Neighbourhood Blue Space, Health and Wellbeing: The Mediating Role of Different Types of Physical Activity." Environment International 131 (2019). https://doi.org/10.1016/j.envint.2019.105016.

Sherret, Alistair, Peat, Marwick, Mitchell & Co., United States Department of Transportation, and United States Department of Housing and Urban Development. *Bart's First Five Years : Transportation and Travel Impacts.* Washington : Dept. of Transportation, 1979.

Société de transport de Montréal. "Stm Presents Its 2020 Annual Report a Year Filled with Challenges." news release, 2021, https://www.stm.info/fr/presse/communiques/2021/la-stm-presente-son-rapport-d-activite-2020-marque-par-de-nombreux-defis.

St-Louis, Evelyne, Kevin Manaugh, Dea Lierop, and Ahmed El-Geneidy. "The Happy Commuter: A Comparison of Commuter Satisfaction across Modes." Transportation Research Part F: Traffic Psychology and Behaviour 26 (2014): 160–70. https://doi.org/10.1016/j.trf.2014.07.004.

"Canadian Perspectives Survey Series 2: Monitoring the Effects of Covid-19, May 2020." The Daily, 2020, accessed January 20, 2022, https://www150.statcan.gc.ca/n1/daily-quotidien/200604/dq200604b-eng.htm.

"Canadians' Mental Health During the Covid-19 Pandemic." The Daily, 2020, accessed January 20, 2022, https://www150.statcan.gc.ca/n1/daily-quotidien/200527/dq200527b-eng.htm.

Verplanken, Bas, Ian Walker, Adrian Davis, and Michaela Jurasek. "Context Change and Travel Mode Choice: Combining the Habit Discontinuity and Self-Activation Hypotheses." Journal of Environmental Psychology 28, no. 2 (2008): 121-27. https://doi.org/10.1016/j.jenvp.2007.10.005.

Waygood, Edward Owen D., G. Boisjoly, K. Manaugh, I.N. Sener, Y. Sun, and B. Wang. "Transport, Social Interactions, and Life Satisfaction During Covid-19." Transportation Research Board 2021 Annual Meeting, Online (Washington, D.C.), 2021.

Waygood, Edward Owen D., Margareta Friman, Lars E. Olsson, and Ayako Taniguchi. "Transport and Child Well-Being: An Integrative Review." Travel Behaviour and Society 9 (2017): 32-49. https://doi.org/10.1016/j.tbs.2017.04.005.

Waygood, Edward Owen D., and Yusak Susilo. "Walking to School in Scotland: Do Perceptions of Neighbourhood Quality Matter?". IATSS Research 32 (2015). https://doi.org/10.1016/j.iatssr.2014.12.002.

Wolch, Jennifer, Jason Byrne, and Joshua Newell. "Urban Green Space, Public Health, and Environmental Justice: The Challenge of Making Cities `Just Green Enough'." Landscape Urban Plann 125 (2014). https://doi.org/10.1016/j.landurbplan.2014.01.017.

Zarabi, Zahra, Kevin Manaugh, and Sébastien Lord. "The Impacts of Residential Relocation on Commute Habits: A Qualitative Perspective on Households' Mobility Behaviors and Strategies." Travel Behaviour and Society 16 (2019): 131-42. https://doi.org/10.1016/j.tbs.2019.05.003.

# INTERWEAVING WELL-BEING AND PLACE IN LOWCOUNTRY LAND USE

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## INTRODUCTION

Agriculture in the South Carolina Lowcountry dissolved as developed land increased commercial, residential, and abundantly luxurious uses. Rampant land development merged with the threat of climate change to the coastal area created a swelling predicament for Lowcountry culture and food production. This economic appetite for tourism inevitably became a dependency. The South Carolina Lowcountry's unbalanced economic drivers established a built environment that disregarded the limits of the natural environment, agriculture, and the local culture. A design approach for a hydroponic greenhouse conceptually based in ecological economic theory, resilience, and eco-design could potentially offer solution by providing infrastructure that reharmonizes local land and economic development with community well-being and the preservation of Lowcountry culture and agriculture.

## CULTURAL AND ECOLOGICAL PRESERVATION

A core objective of this paper was a design developed from the advancement of a research framework founded on principles of resilient design and ecological economics catalyzed by cultural preservation specifically in the Hilton Head-Bluffton area. The American Institute of Architects created a *Disaster Assistance Handbook* which provided architects with guidelines for preparation, response, and responsibilities related to disaster situations. The AIA's comprehensive handbook provided the *Architects' Holistic Approach to Community Resilience* which was a process concerned with achieving and maintaining resilience within a community through analysis of the locality's: natural resources, disaster & climate resilience, social equity, health, safety, & wellness, and economic equity.[1] *The Five Pillars of Economic Development* by Dr. Sabine O'Hara defined indispensable economic necessities for community development. The pillars Dr. O'Hara established were measurement tools of access to: education, health and wellness, cultural and social amenities, environment quality and recreation, and technology and transportation.[2] In S*trategies for Green Design* Architect and Ecologist Ken Yeang's elucidated an eco-design theory based on four eco-infrastructures. Yeang advocated strategies that interwove: natural resources, water management, sustainable technology, and human life.[3]

The design concepts Ken Yeang posited were parallel to the approaches from *The Resilient Handbook* and *The Five Pillars of Economic Development.* The AIA's approach was for improvement of resiliency from the natural and artificial environments. Dr. O'Hara's pillars concentrated on the betterment of the relationships between the ecological and economic environments. Dr. O'Hara, the AIA, and Ken Yeang through their respective methodologies provided adaptable tools for development of design solutions, which were hybridized through an application of cultural

preservation for the design presented in this paper. Albeit from different perspectives the reviewed theories and approaches were concerned with the intertwined processes of human life, societal, and natural environments. The solution to land use in the Lowcountry requires addressing developed land uses' sterilization of local culture. The utilization of cultural preservation as a solution driver allowed this project an opportunity to expand the antecedent conceptual frameworks into an interdisciplinary design solution.

## Gullah Geechee Cultural Corridor

The Hilton Head-Bluffton area is situated in the Gullah Geechee Cultural Corridor, U.S. Congress designated a National Heritage region- as illustrated in Figure 1. Gullah Geechee is a resilient culture comprised of foodways, art forms, belief systems, and language practices of African Americans descended from West Africans who were enslaved in North Carolina, South Carolina, Georgia, and Florida.[4] Anthropologist Joseph Opala is credited with making the link between the Gullah of the United States Lowcountry and West Africa, particularly Sierra Leone; Opala found that the foodways, language, and artistic traditions of the Gullah people of South Carolina and Georgia, the descendants of Africans forcibly brought to the United States to grow rice, indigo, and cotton, were similar to that of the people of Sierra Leone.[5]

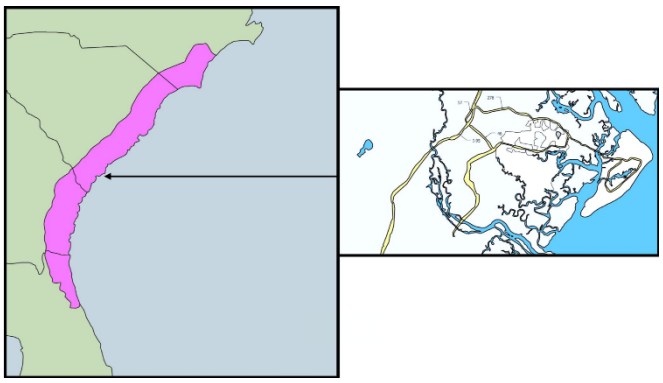

*Figure 1. Gullah Geechee Cultural Corridor*

## Hilton Head-Bluffton Area Economy

The design site is in Bluffton, South Carolina, a Beaufort County town directly adjacent Hilton Head Island, SC. The two townships have a combined population of about 65,000 people.[6] For more than half a century the expected profitability of tourism drove land use and economic development of the area- see Figure 2; as of 2020 Marriott Resorts and SeaPines Resort remained the largest employers in Beaufort County. The SeaPines Resort accounted for one third of Hilton Head Island's land mass.[7] The forty golf courses in the Hilton Head-Bluffton area made the Lowcountry a destination for golf enthusiasts and professional tournaments.[8] Lowcountry land development limited the areas where native plants used as basket weaving materials grew.[9] Unlike golf, sweetgrass baskets were inseparable from the culture and history of South Carolina; not only is basketweaving an art form indicative of Gullah Culture, it's the South Carolina State art form.[10]

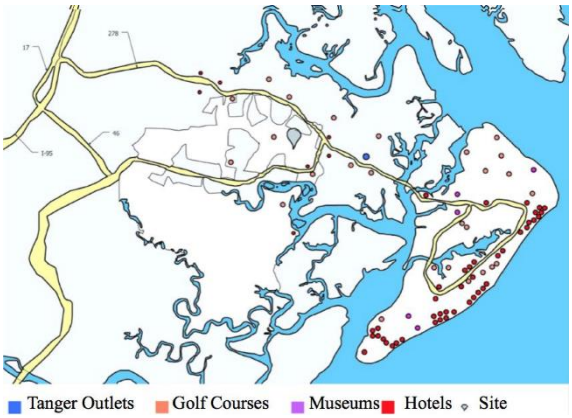


*Figure 2. Hilton Head-Bluffton Land Use Map*

The Lowcountry's previous isolation combined with human resilience contributed to the Gullah people's preservation of African cultural traditions, tourism driven residential and commercial land development maintained a threat to the preservation of Lowcountry agriculture, Gullah culture, as well as the ecological and economic environments. People ages 25-34 made the largest demographic of those employed by the hospitality and service industries in Beaufort county. Additionally, Beaufort County young people under 21 primarily performed hospitality and retail jobs.[11]

## LOWCOUNTRY HYDROPONIC AGRICULTURE CENTER

The Lowcountry Hydroponic Agriculture Center (LHAC) consisted of three structures: a commercial hydroponic greenhouse, administrative building, and cultural center. The 100,000 square foot commercial greenhouse programmed: a 85,000 sf of food production space, a 8,583 sf dining patio, a 2,108 sf nursery, 1,475 sf of crop storage, 738 sf for restrooms, a 512 sf mechanical room, 1582 sf of lobby space- see Figure 3.

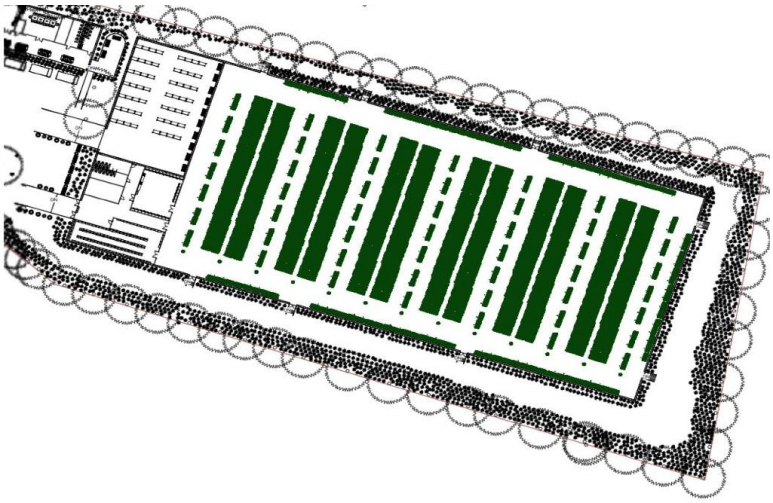

*Figure 3. LHAC Commercial Greenhouse Floor Plan*

The administrative building was 4300 sf which consisted of: 1673 sf of open administrative space, a 908 sf conference room, a 430 sf break room, 641 sf for restrooms, 87 sf of storage, a 240 sf mechanic room, and 320 sf of lobby space- Figure 4.

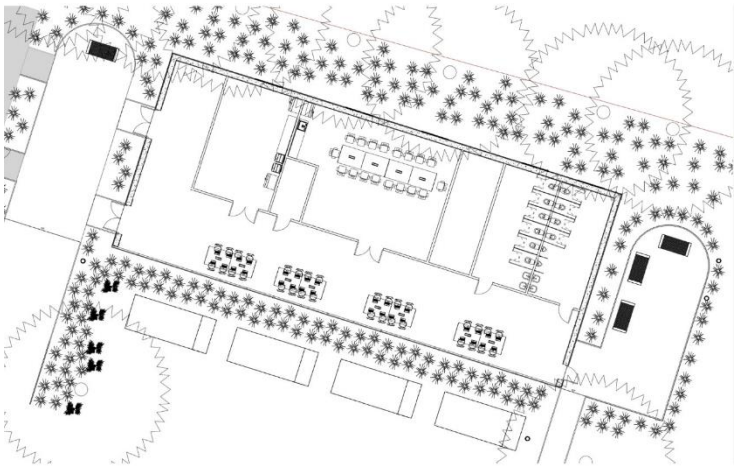

*Figure 4. LHAC Administrative Building Floor Plan*

The Cultural center was: 15,098 sf, a 7,549 sf hydroponic lab, 1,345 sf lobby space, a 2,882 sf research library, 670sf restrooms, and 2,650 sf of gallery space- see Figure 5.

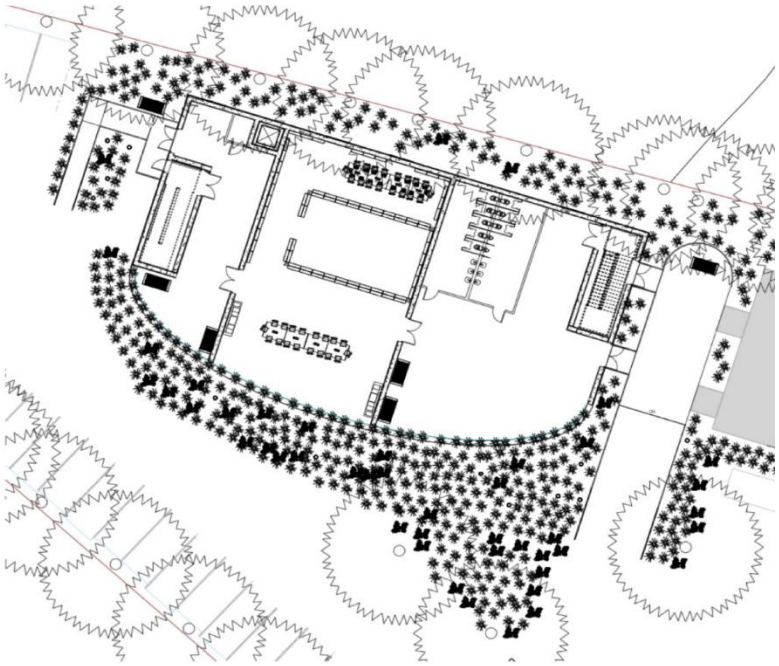

*Figure 5. LHAC Cultural Center Floor Plan*

All three structures utilized Insulated Concrete Form walls with a clad exterior made from Tabby, a type of concrete that used oyster shells as aggregate and is quintessential to the South Carolina architecture colloquium.[12] The Commercial Greenhouse's South-east, Southern, and Western facades housed bio photovoltaic algae panels- illustrated in Figure 6.


*Figure 6. LHAC Commercial Greenhouse Wall Sections*

These panels were also installed on the Southern facade of the administrative building and the cultural center's rooftop greenhouse- illustrated in Figure 7.

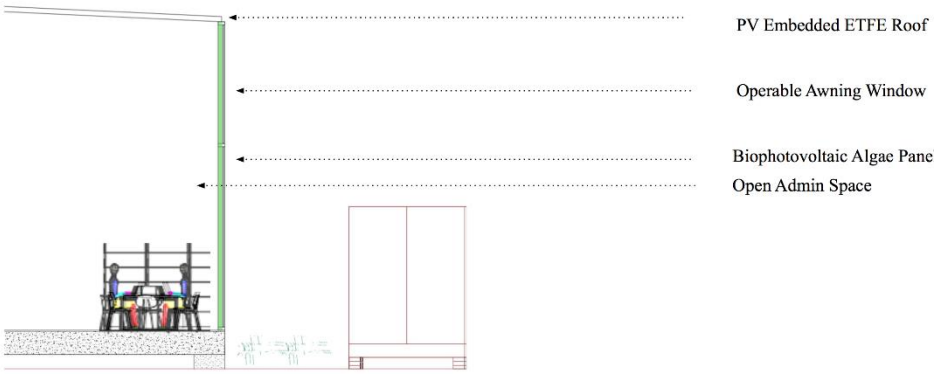


*Figure 7. LHAC Administrative Building Section*

The bio photovoltaic algae panels provided energy, heat, food, and solar protection to the Lowcountry Hydroponic Agriculture Center's buildings. The greenhouse dining patio was developed into a sheltered outdoor space that could be enclosed from harsher elements and weather with a built in ethylene tetrafluoroethylene (ETFE) protective curtains- illustrated in Figure 8. All three Lowcountry Hydroponic Agriculture Center structures incorporated ethylene tetrafluoroethylene film roofs with embedded photovoltaic cell sheets.

*Figure 8. LHAC Commercial Greenhouse Sections*

The cultural center housed a research library and rooftop hydroponic lab. The south facade was open to the elements. The South wall was a short ICF wall with a planted embedment in the top, which was filled with native palm plants commonly used as binding in basket weaving. This open facade aimed to ground the center and visitors in the natural environment and landscape. The Lowcountry derived an immense amount of its culture from the land and its uses, a center preserving the Lowcountry culture must be immersed in the land and ecological environment. The "vanished" Southern wall was replaced with a ethylene tetrafluoroethylene curtain to protect the cultural center spaces from the weather without removing the sense of outdoors- illustrated in Figure 9.


*Figure 9. LHAC Cultural Center Section*

The site was planted with Muhlenbergia Filipes or sweet grass, a native plant that is a staple for basket weaving. Sweet grass was used to weave the circulation of the site to flow visitors towards the cultural center, food truck garden, and dining patio. Sweet grass wrapped the site to create a natural trail around the commercial greenhouse that can be utilized as a brief low impact basket weaver's hike- illustrated in Figure 10. The Lowcountry Hydroponic Agriculture Center provided a space for visitors to research local culture and hydroponics. Melding Science, Technology, Engineering, Arts, and Mathematics based education with culture drove the project's programming. The Lowcountry Hydroponic Agriculture Center fed the community with its crops, knowledge, and opportunities for self-discovery.

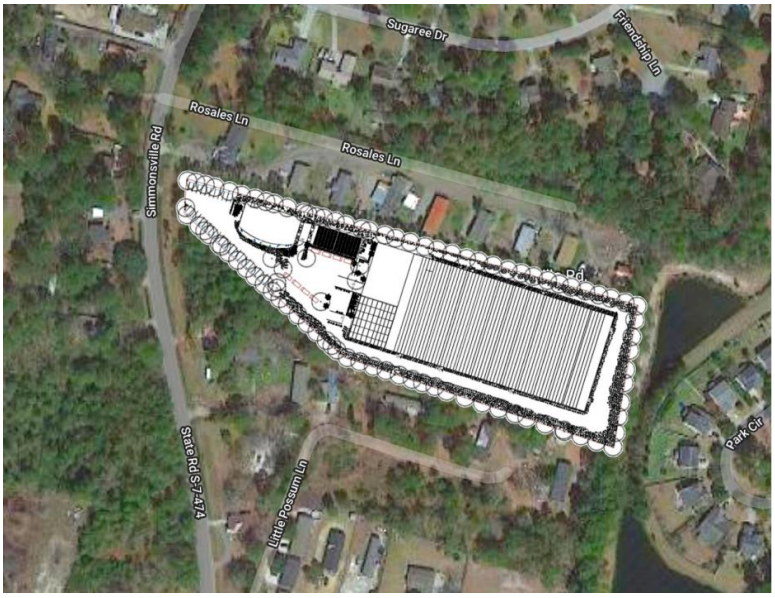


*Figure 10. LHAC Site Plan*

## FOOD SECURITY

The land development driven by the economic desire for tourism caused the evaporation of Lowcountry agriculture. The Bluffton Farmers' Market had nineteen vendors, only seven were farms. The closest farm vendor was in Savannah, Georgia; the two Beaufort County farm vendors were almost twenty miles further than the Savannah farm.[13] There were greenhouses operated on Hilton Head at the Johnson Urban Farm but the farm closed.[14]

## WELL-BEING

The Lowcountry Agriculture Center was a model profitable resilient business which would donate food to its local community. The project's design was driven by inclusivity, and creating a form of sustainable development that nourished the community with healthy food, education and employment opportunities, and a scientific yet mystic space that visitors local and international and experience and feel inspiration to grow themselves and the world and around them- Illustrated in Figure 11 and Figure 12. The Lowcountry Hydroponic Agriculture Center addressed food security and aimed to achieve an equitable profitability by combining ecological stewardship and cultural preservation with structures that fed and inspired the community- illustrated in Figure 13. LHAC's recreational amenities served preservation efforts culturally and ecologically through a holistic economic development based design solution. The Lowcountry Hydroponic Agriculture Center's design approached developed a sense of place through culture, ecology, STEAM education, and sustainable economic development aimed to improve community well being.

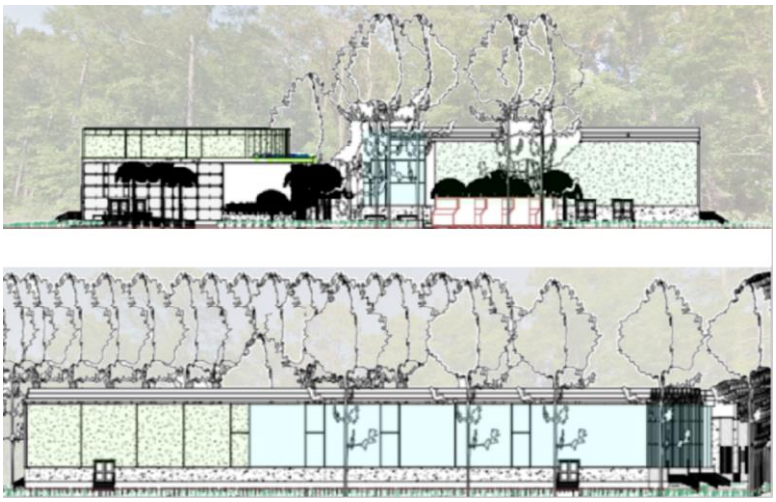

*Figure 11. LHAC West and East Elevations*

*Figure 11 LHAC North and South Elevations*

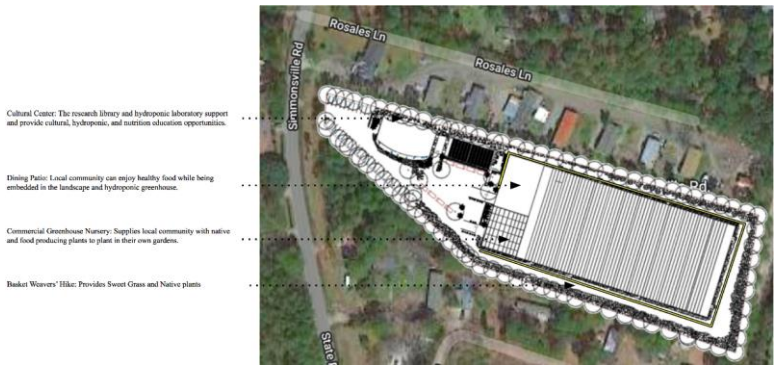


*Figure 13 LHAC Well Being Solutions*

## CONCLUSION

The Lowcountry Hydroponic Agriculture Center (LHAC) was an exemplary application of resilient architecture, see Figure 14, and hydroponic agriculture to the market failure created by tourism dependence. The project presented a sustainable business model that fed the local community and supported its well-being. The project's multi-pronged solutions potentially ignite the reversal decades of a tourism dominated economy. The LHAC was designed to inspire sustainable lifestyle changes, support cultural and ecological preservation efforts, and provide sustenance and programing that supported the well- being of the Lowcountry community.

The cultural center research library and hydroponic laboratory created opportunities for visitors from the local community and abroad to educate themselves about the local culture, hydroponic agriculture, nutrition, and ecology. The food truck garden promoted local culinary businesses and established a thread in the LHAC economic network. The commercial greenhouse produced nutritious food to be given to the community and for sale in local marketplaces. Additionally, the greenhouse contributed to the local well-being via the Basket Weavers' Hike wrapping the structure. The Dining Patio embedded in the greenhouse was a space that immersed diners in the landscape and attempted realign the local sense of place with its ecology and culture.

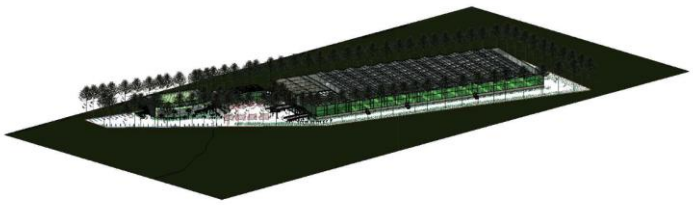

*Figure 14 Lowcountry Hydroponic Agriculture Center*

## NOTES

[1] J. Scott Eddy, AIA and Janine Glaeser, AIA, *Disaster Assistance Handbook* (American Institute of Architects, 2017), 10-11.
[2] Sabine O'Hara, *The Five Pillars of Economic Development: A Study of Best Practices for the Roanoke Valley* (Salem, Virginia: Roanoke College, 2007), 1-52.
[3] Ken Yeang et al. "Strategies for Green Design" International Conference on Sustainable Building Asia, SB10 Seoul (2009): 46-51.
[4] "Business Resources" Hilton Head Chamber of Commerce, accessed November 26, 2020, https://www.hiltonheadchamber.org/business-resources/press-and-media/fast-facts/#:~:text=Approx.,and%202.67%20million%20visitors%20annually
[5] Joesph A. Opala, *The Gullah,* (South Carolina: U.S. Department of State, 2009) 1-37.
[6] Community Profile: Beaufort County. (South Carolina: S.C. Department of Employment & Workforce, 2022), https://lmi.dew.sc.gov/lmi%20site/Documents/CommunityProfiles/04000013.pdf
[7] "SeaPines," SeaPines Resort accessed November 26, 2020, https://www.seapines.com/
[8] "Business Resources," Hilton Head Chamber of Commerce, accessed November 26, 2020, https://www.hiltonheadchamber.org/business-resources/press-and-media/fast-facts/#:~:text=Approx.,and%202.67%20million%20visitors%20annually
[9] Angela C. Halfacre, *A Delicate Balance: Constructing a Conservation Culture in the South Carolina Lowcountry*. (Columbia, South Carolina: University of South Carolina Press, 2012) doi:10.2307/j.ctv6wgh72 https://www.jstor.org/stable/26217482.
[10] "Discovering the Legacies of African Cultures," Gullah Geechee Cultural Heritage Corridor Commission. accessed November 26, 2020, https://gullahgeecheecorridor.org/.
[11] Community Profile: Beaufort County. (South Carolina: S.C. Department of Employment & Workforce, 2022), https://lmi.dew.sc.gov/lmi%20site/Documents/CommunityProfiles/04000013.pdf
[12] Thomas C. Barnewell Jr, Carolyn Grant, and Emory Shaw Campbell. Gullah Days: Hilton Head Islanders Before the Bridge 1861-1956. (Durham; Blair/Carolina Wren Press, 2020).
[13] "Farmer's Market Bluffton," Farmer's Market Bluffton, accessed November 26, 2020, https://www.farmersmarketbluffton.org/
[14] "Johnson's Urban Farm-Hilton Head South Carolina," Trip Advisor, accessed November 26, 2020, https://www.tripadvisor.com/Attraction_Review-g54273-d9865344-Reviews-Johnson_s_Urban_Farm-Hilton_Head_South_Carolina.html

## BIBLIOGRAPHY

Asao, T., Asaduzzaman, M., and Md., M. (2014). Horticultural Research in Japan. Production of vegetables and ornamentals in hydroponics, constraints and control measures. *Advances in Horticultural Science*, 28(4), 167-178. accessed October 16, 2020, http://www.jstor.org/stable/24586831

Brittaine, Richard, "Fresh salads for remote resorts." The Horticulturist, (2013), 22(1), 8-9. doi:10.2307/48518444

Despommier, D, Vertical Farm: Feeding the world in the 21st century. Picador . 2020.

Dickson, D. *The Vertical Farm: Feeding the World in the 21st Century*. New York, NY: St. Martin's Press, 2010.

Dirksen, K.. More than work:Tokyo office grows own food in vertical farm [Video file] (2016, January 24),. accessed 2020, from https://faircompanies.com/videos/more-than-work-tokyo-office-grows-own-food-in-vertical-farm/

Esri Community Maps Contributors, BuildingFootprint USA, Esri, Here, Garmin, SafeGraph, Increment P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, .. (2020). Public Mapping Site Beaufort County 20112 [Map]. In Public Mapping Site. Accessed 2020, from https://gis.beaufortcountysc.gov/publicmapping/?esearch=R610%20039%20000%200175%200000&slayer=0&exprnum=0&showdatagrid=false

Farmer's Market Bluffton. accessed November 26, 2020, https://www.farmersmarketbluffton.org/

Feeser, A. Red, White, and Black Make Blue: Indigo in the Fabric of Colonial South Carolina Life. Athens, GA; University of Georgia Press. accessed November 26, 2020, from http://www.jstor.org/stable/j.ctt46n4sb, 2013.

Gibson, Tom. (2018). Room To Grow. *ASEE Prism*, 27(7), 26-31. doi:10.2307/26820026

Greens, Gotham. “Our Farms.” accessed 2020, https://www.gothamgreens.com/our-farms/

Gullah Geechee Cultural Corridor Commission. “Discovering the Legacies of African Culture” accessed November 26, 2020, http://visitgullahgeechee.com/

Halfacre, Angela. *A Delicate Balance: Constructing a Conservation Culture in the South Carolina Lowcountry*. Columbia, South Carolina: University of South Carolina Press. (2012). doi:10.2307/j.ctv6wgh72

Halfacre, A., Hurley, P, and Grabbatin, B. Sewing Environmental Justice into African-American Sweetgrass Basket-Making in the South Carolina Lowcountry. *Southeastern Geographer*, 50(1), 147-168. accessed December 3, 2020, http://www.jstor.org/stable/26225595 2010.

Joseph, J., “Meeting at Market: The Intersection of African American Culture, Craft, and Economy and the Landscape of Charleston, South Carolina.” Historical Archaeology (2016)., 50(1), 94-113. Accessed December 3, 2020, from http://www.jstor.org/stable/24757049

Joseph, J. “Meeting at Market: The Intersection of African American Culture, Craft, and Economy and the Landscape of Charleston, South Carolina.” Historical Archaeology, 50(1), 94-113. Accessed November 26, 2020, http://www.jstor.org.proxydc.wrlc.org/stable/24757049, 2016.

Kono Designs. Pasona Urban Farm. (2016). accessed 2020, from http://konodesigns.com/urban-farm/

Latzko, D. Mapping The Short-Run Impact of the Civil War and Emancipation on the South Carolina Economy. *The South Carolina Historical Magazine*, 116(4), 258-279 accessed November 26, 2020, http://www.jstor.org.proxydc.wrlc.org/stable/44289835

Midmore, David, & Deng-lin, Wu. Work that water! Hydroponics made easy. *Waterlines*, 17(4), 28-30. December 3, 2020, from http://www.jstor.org/stable/ 24681608 1999.

Miller, J., Boumtje, P., & Johnson, R.. Investment Analysis for Commercial Greenhouse Hydroponically Produced Lettuce and Tomato. Journal of Asfmra, 1-10. Accessed November 26, 2020, https://www-jstor-org.proxydc.wrlc.org/stable/90016140, 2017.

Nash, R.,South Carolina indigo, European textiles, and the British Atlantic economy in the eighteenth century. The Economic History Review, (2010). 63(2), 362-392. accessed November 26, 2020, http://www.jstor.org.proxydc.wrlc.org/stable/27771617

No Soil Solutions, M. 6 different types of hydroponics. accessed 2020, https://www.nosoilsolutions.com/6-different-types-hydroponic-systems/ 2019.

O'Hara, Sabine. *The Five Pillars of Economic Development: A Study of Best Practices for the Roanoke Valley*. Salem, Virginia: Roanoke College. 1-52, 2007.

S.C. Department of Employment & Workforce. (2020) Community Profile: Beaufort County.

SeaPines. “SeaPines” accessed November 26, 2020, https://www.Seapines.com/

Thomas C. Barnwell Jr, Carolyn Grant, and Emory Shaw Campbell. Gullah Days. Durham, Blair/Wren. Press. 2020.

Vitiello, D., & Wolf-Powers, L. Growing food to grow cities? The potential of agriculture foreconomic and community development in the urban United States. *Community Development Journal*, 49(4), 508-523. doi:10.2307/26166184, 2014.

White, M. Freedom Farmers: Agricultural Resistance and the Black Freedom Movement. Chapel Hill: University of North Carolina Press. Accessed November 26, 2020, from http://www.jstor.org/stable/10.5149/9781469643717_white, 2018.

White, M. Freedom Farmers: Agricultural Resistance and the Black Freedom Movement.(Chapel Hill: University of North Carolina Press, 2018) accessed November 26, 2020, http://www.jstor.org/stable/10.5149/9781469643717_white., 2018.

Yeang, Ken. “Strategies for Green Design.” International Conference on Sustainable Building Asia, SB10 Seoul, (2009): pgs. 46-51, 2009.

Yu, Douglass.“Gotham Greens Opens New Greenhouse In Colorado As Local Businesses Slowly Reopen After COVID-19 Pause.” Forbes. Retrieved February 2, 2021, from https://www.forbes.com/sites/douglasyu/2020/05/20/gotham-greens-opens- new-greenhouse-in-colorado-as-local-businesses-slowly-reopen-after-covid-19- pause/?sh=650666264faa., 2020

# MAPPING INSTABILITY: THE EFFECTS OF THE PANDEMIC ON THE CIVIC LIFE OF A SMALL TOWN

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## INTRODUCTION

The Covid-19 pandemic has affected our global society in drastic and immeasurable ways and many of the impacts we are so far unable to categorize or quantify. The work on this project developed in response to the observations made during the lockdown, both personally and professionally. The built environment is both the locus to which we add our projects and the landscape that shapes our surroundings. Faced with the now too familiar challenges of life during the lock down: school closures, remote work, lack of access to services and many forms of leisure, we soon realized that the effects of the pandemic, both visible and invisible, echoed back to the now empty streets of our small town. Located in an agrarian and previously industrial part of Massachusetts, the town in which we live now serves as the host of the state University flagship campus as well as a conglomerate of private colleges (the University and the colleges are commonly referred to as the Five College Consortium.) The population of this town nearly doubles during the academic year, and many of the services and small businesses located in and around the town are directly or indirectly connected to the collegiate population. Due to the vibrant academic scene, offering a rich and diverse host of artistic and athletic activities, the area continues to attract residents who enjoy the benefits of living in a small city within the reach of two large metropolitan areas (Boston and New York) while offering many of the amenities of a small town. These benefits have contributed to a large influx of people who come to Amherst to live or retire.

Following, a large population of Amherst is made up of college age and university age students, the majority of which attend the University of Massachusetts. The pandemic directly impacted the presence of the students from UMass and the surrounding colleges, but in disparate ways; while UMass students were sent home, the students from Amherst college and the other neighboring liberal arts colleges were provided some form of residency (still, extremely limited to a life within the confines of their small campuses). To investigate this phenomenon, our interdisciplinary team of architects and computer scientists began an investigatory process of tracking movement and mapping patterns of mobility as it is related to the unmeasured aspects of the pandemic. It is from these observations that our team set out to analyze the short-term and long-term effects of the pandemic, specifically regarding the residents of a small town. We had a special interest in studying issues related to mobility and access to collective resources and were invested in using our specialized ways

of researching and individual interests in the built environment and digital civics to investigate larger patterns of how a major crisis and its social, economic, and cultural repercussions affect one's sense of community, mobility, and social connectedness.

## FROM INTUITIONS AND OBSERVATION TO FORMING DIRECTIONS

In large cities, dwelling, working, socializing, commuting, and mobility rely on collective infrastructures which operate at an urban and territorial scale to keep the rhythm of daily life constant. However, in smaller towns such as Amherst, Massachusetts, which lack these integrated structures, the routines of life and work are different, relying mostly on individual resources and spaces, and self-created or sustained structures.[1] For example, local farmers and vendors supply food and resources to many local stores, stands, and cafes, many of which gather at the weekly Amherst Farmers' Market during the summer and, biweekly, at the Hadley Farmers' Market in Hampshire Mall during the winter. The localized Farmers' Market also provides an opportunity for community socializing, interaction, and education; but, like many industries, the pandemic affected local agricultural production and thus deeply impacted the resources available at the normally consistent market.[2] Here, in a rural community, the changes and disruptions become more eschewed as they may result in irreparable damage to the daily lives of residents. However, while there are many conditions that may affect small town daily life negatively, there have been moments of resourcefulness and ingenuity displayed by the residents and community at large. One instance is an initiative by the Amherst public health director who partnered with local ambulance and firetruck drivers in order to administer Covid-19 vaccines to Amherst residents with limited transportation mobility.[3] Another local initiative involved a librarian from the Amherst Public School System, who decided to make sure children had access to books during the lockdown by forming a network of volunteers and hand-delivering curated bags of books to individual students, appropriately selected for each one, based on age range and classroom level.[4]

In our project, we began comparing these unique anecdotes along with own experiences to larger population changes and movement patterns among the local residents, and the students of the University and colleges. For many residents, the previous lines of home-life, work-life, and school-life—particularly in connection to the educational institutions—were no longer distinct, superimposed onto each other at times, threatening any semblance of a balanced life. Many students, regardless of location, have found themselves learning and working from home, often with now additional home and family-oriented responsibilities.[5] This extreme change in routine has impacted students' motivation, academic performance, social lives, financial situation, and ultimately, mental health.[6] [7] [8] These changes in mobility, attitude, and ways of thinking will affect all of our public and private lives for years to come—and we are still unsure exactly at what scale and how drastically these changes will affect us long term.

The above stated anecdotes point to momentary and continuous disruptions of social structures which will eventually permanently affect our living environments, both on a larger scale in our communities, and on a smaller scale, within our homes. Our interests for this study ultimately lie in answering big questions referring which can help us grapple with these presently unknown changes. For instance, how do these momentary or continuous disruptions to our social structures affect our living environments? What are the consequences of this pandemic on our lives and the town in which we live? What resilient strategies can be put into place to sustain and protect us in the face of such devastating occurrences?

Instead of reacting to these major questions with results that we cannot yet quantify, we set out to pursue gathering data that can shed light on how our known patterns of life and work have given way to new ways of conducting ourselves and our society at large.

## OUR APPROACH TO GATHERING DATA IN AN EQUITABLE MANNER

A first step towards investigating these larger concepts was collecting data from the public that may enable us to begin to analyze the impact of the pandemic on small town citizens; thus, we felt that much of the data on which our project should be based is from firsthand experiences and accounts. In *normal* circumstances, we might have proposed to collect this data through in-person interviews, focus groups, or social observations—but with the current crisis, these traditional methods of collection were not possible and are still, presently, difficult to organize in a safe manner.

Accommodating our need to collect data remotely, we moved to considering online civic engagement platforms, such as "CommunityCrit,"[9] and online surveys, both tools which allow people to provide information and opinions at their own discretion and from the secluded safety of their own homes. Still, both platforms, while safe and reliable methods of data collection, lacked the ability to engage their participants in larger conversations that may sustain dialogue and encourage a more genuine opinion out of the members. A shared conversation has the unique ability to help people communicate their struggles, needs, and issues through a shared sense of mutual understanding, experience, and connection. To do so, we chose to design our project around an emergency type of Artificial Intelligence-based conversational chatbots, called "CivicBots." These CivicBots can engage in and sustain a complex and multi-layered conversation, which can change the user experience into one of a social activity which in turn improves interest, engagement, productivity, depth of information gathered, and the ultimate quality of outcomes. This platform provides us with the ability to both keep our audience safe, but also interested and engaged.

## CONCEPTUALIZING THE CIVIC BOTS

While the CivicBots were the most promising tool for our project, we still encountered many design challenges. One of the most prominent dilemmas was related to the demographics of the users and how this may impact the quality of the information gathered. Throughout our design process, we continually analyzed the effects of age, education, language proficiency, living situation, and employment status on the perceived usefulness and effectiveness of CivicBots. Another challenge was creating a chatbot that was engaging and "personable," to instill a sense of trust in the user helping them to share their genuine thoughts and feelings. Finally, we grappled with how to evaluate the dialogue quality, and how to build measures into the community agents data collection and storage mechanisms to preserve an individual's privacy.

## PROBING THE PARAMETERS OF CIVIC LIFE AND MOBILITY THROUGH A CONVERSATIONAL PLATFOM

Last winter—in January 2021—the Architecture segment of our team began a brainstorming charette wherein expansive lists of questions and curiosities relating to Covid-19 were discussed and recorded. Many of these questions addressed ways in which the pandemic had changed our personal lives in our recent past, current present, and the possibilities of a change in our impending futures. We initially worked with a Google Document amounting to 10 pages of questions, wherein we were able to organize the questions into larger topics and categories. Our work started before the distribution of the vaccines at the height of the lockdown, and we later annexed questions about the later stages of the pandemic. Understanding that there may be overlap within each category or areas of shared interests, we required a more flexible tool that would allow us to understand and easily experiment with the way in which subjects were related to one another, and how we might be able to create specific categories that were part of a larger conversation.

We settled on using an online platform called "Miro," self-described as a "Visual Collaboration Platform."[10] The organization of Miro is quite simple; it has a few essential tools such as post-it notes,

tables and diagrams, text, and custom flow-chart arrows, but allows multiple users to work within the same document at the same time. This workflow allowed our team to post each question and topic of investigation and implement flow chart arrows to experiment with various conversational flow possibilities; such a process allowed us to begin the design of the chatbot conversational flow in an early conceptualization phase, allowing a natural conversational progression.

Using Miro helped us realize that introductory demographic questions were a crucial part of understanding how to direct the conversation for each individual participant. Creating a way to collect demographic information became an important part of the data collection process, wherein we designed pre-study questionnaires to be administered to chatbot participants, helping to guide the conversations in meaningful ways. Using the demographic questions, we were able to recognize separate conversational categories related to mobility and the built environment and positioned each category as part of a larger whole. The conversational categories consist of twelve topics, addressing separate aspects of home and public life as it related to the pandemic. The first two categories, "Households," and "The Indoors" addresses changing aspects of the household, family sizes, feelings of entrapment inside the indoor environment, and leaving the home.

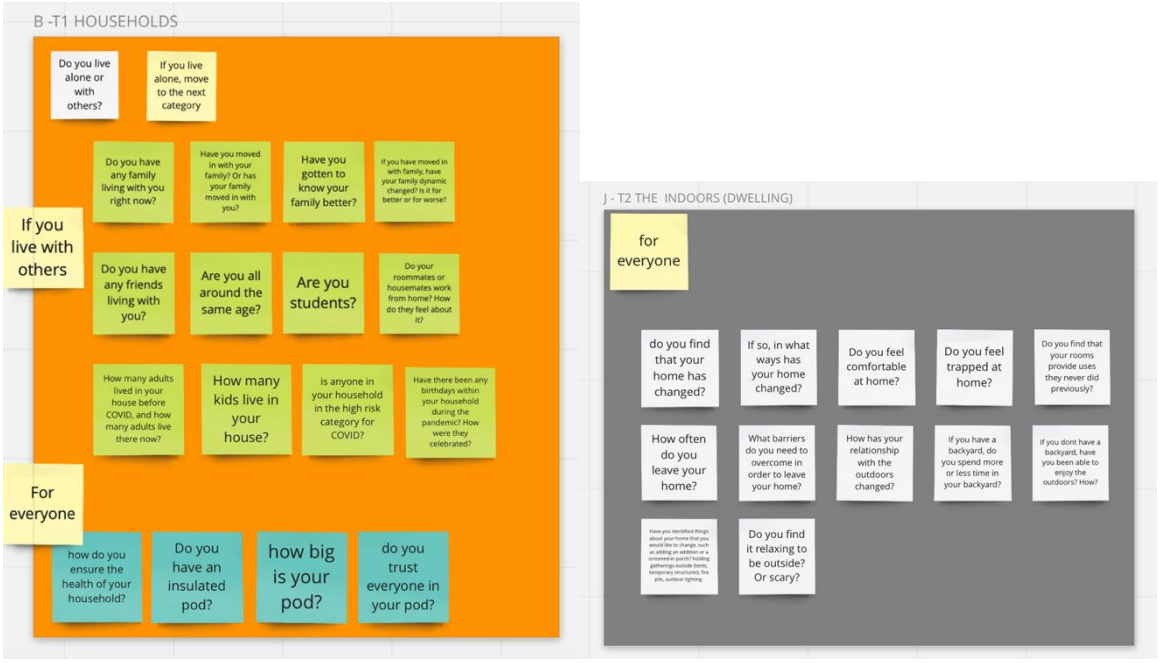


*Figure 1. Households + The Indoors, (Snapshot from Miro Board).*

The "Education" category was developed in two parts: education for adults and teens, and education for children, separately considering remote learning in households with small children, and also remote learning for high school and college age.

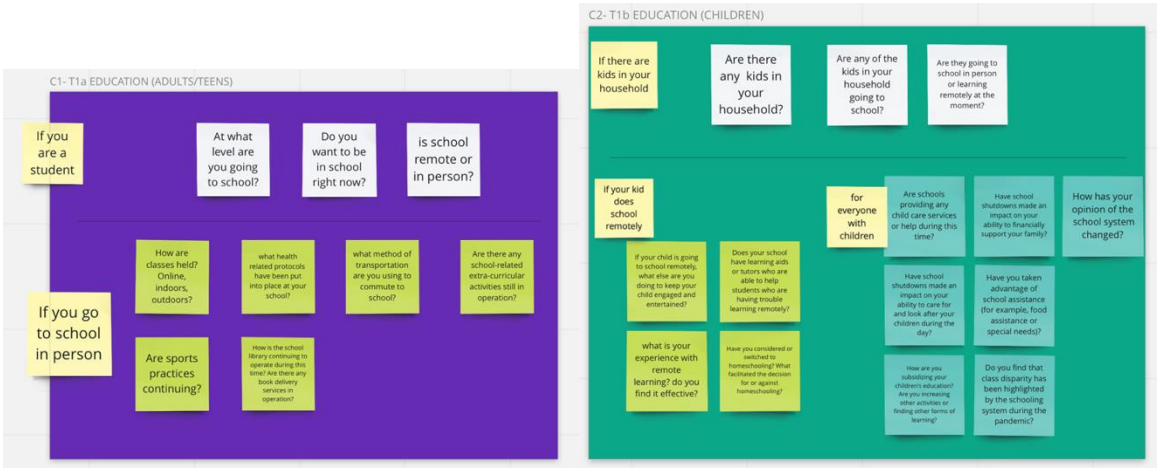


*Figure 2. Education: Adults/Teens + Children, (Snapshot from Miro Board).*

"Transportation" was of particular interest as it related directly to mobility throughout the pandemic, it covered modes of transportation around public places, commutes or lack thereof, and movement preferences as related to health and safety. A similar category, "Delivery," was also of particular interest, as previously delivery services were virtually nonexistent in our rural town, and the pandemic brought with it an introduction of food delivery services and a perceived increase in online deliveries.

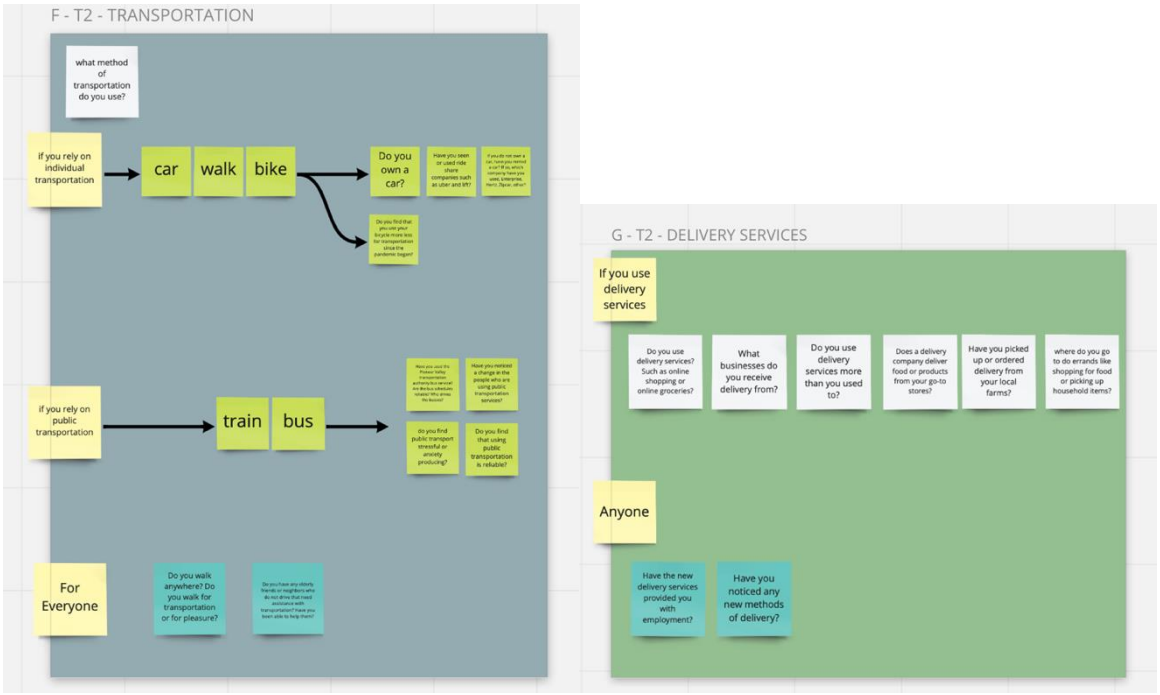


*Figure 3. Transportation and Delivery Services, (Snapshot from Miro Board).*

Other than Education, the "Work" category was perhaps the most expansive category; it was an arena in which our team had observed the largest amount of change. Figure 4, below, displays questions about remote work, working at home with children, continuing to work in person throughout the height of the pandemic, and loss of employment.


*Figure 4. Work, (Snapshot from Miro Board).*

Health and Wellbeing, pictured in Figure 5 below, introduced concepts of telemedicine, preventative care, as well as the inevitable consequences of the pandemic on mental and social health.

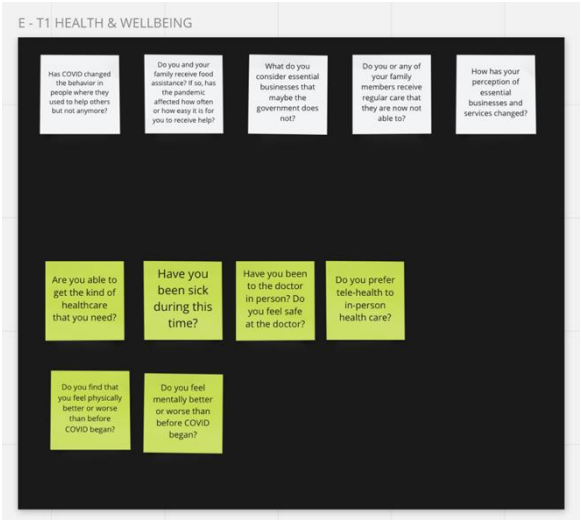


*Figure 5. Health and Wellbeing, (Snapshot from Miro Board).*

"Leisure," was split into three categories: Virtual Leisure, Physical Leisure, and Just Leisure. This category included changes in elective physical activity, down time spent in front of virtual screens, as well as miscellaneous questions related to "unnecessary" actions outside the home.

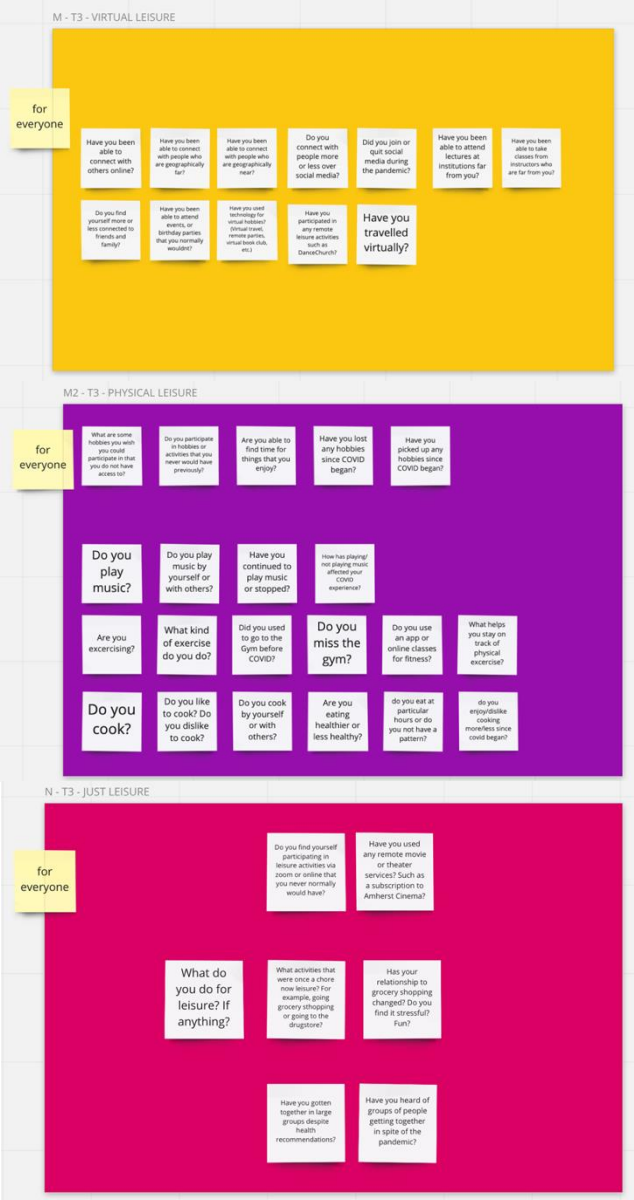


*Figure 7. Leisure (Snapshot from Miro Board).*

As a collective group, we found concepts of religious and non-religious worship particularly interesting, i.e. how regular services continued during times when social distancing was required, or if a spiritual practice (such as yoga or meditation), was essential for any of the participants—the "Worship" category is shown in Figure 8, below. The "Technology" category, likewise, was an interesting subject in that it inquired about human connection through screens and online platforms.

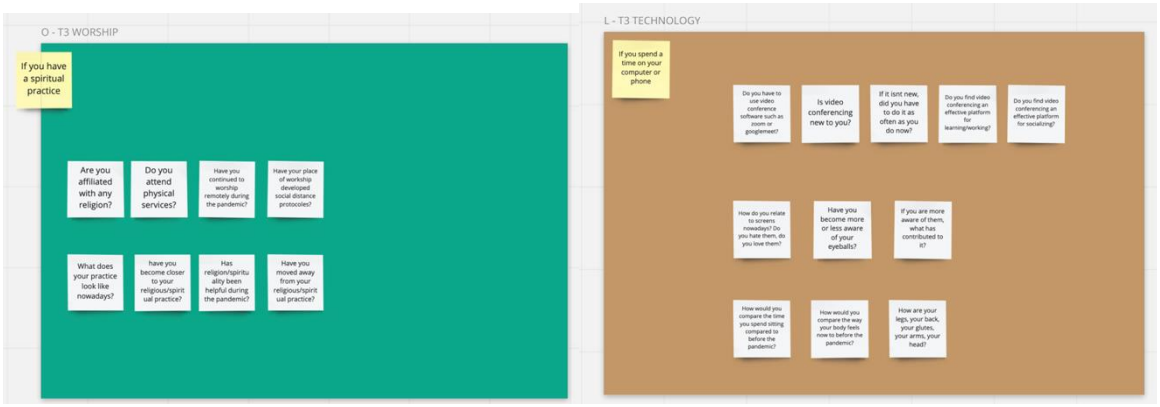


*Figure 8. Worship and Technology (Snapshot from Miro Board).*

In contrast, "The Outdoors," below, addressed how changing weather, seasons, and collective pandemic attitudes affected outdoor activities and social interaction.

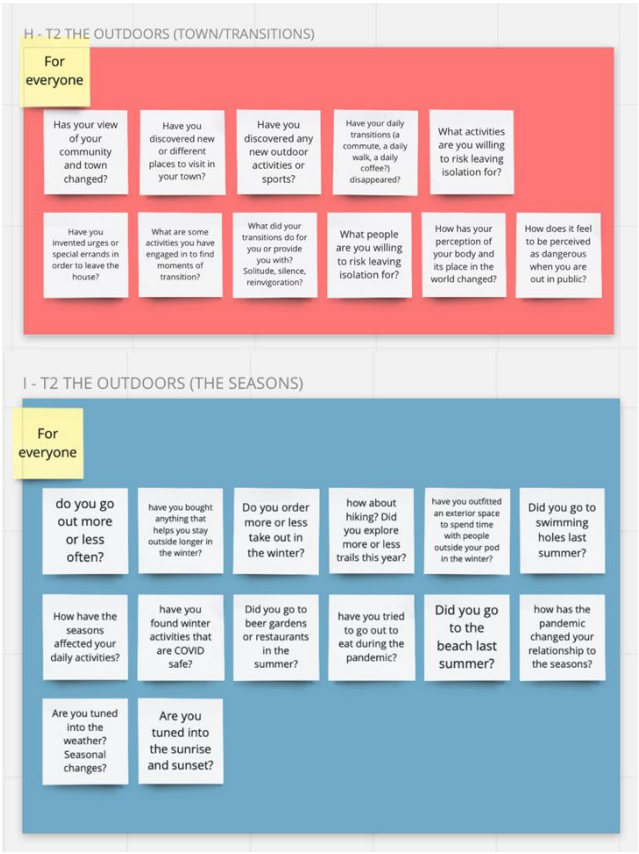


*Figure 9. The Outdoors (Snapshot from Miro Board).*

The final category was "Daily Life," and covered changed routines, sleep, and daily transitions.

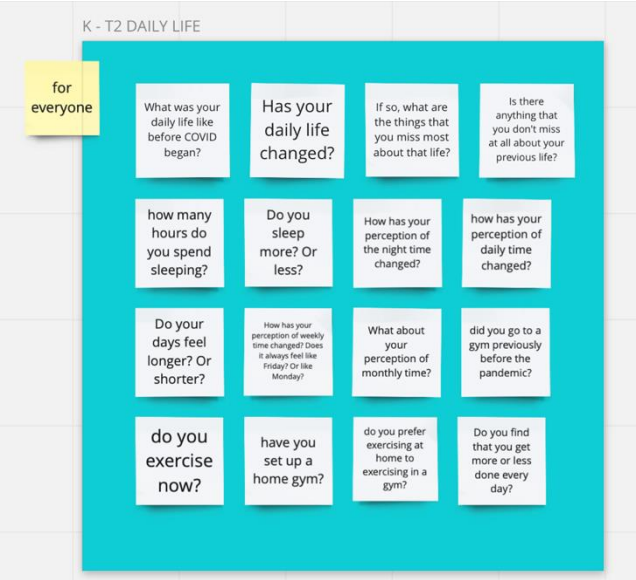


*Figure 10. Daily Life (Snapshot from Miro Board).*

Throughout various iterations, we were able to begin to create an organized and linear way of approaching the larger questions at hand and using an iterative process. In addition, using this iterative process and a communal, online based tool allowed the computer science team to collaborate with us, and direct the organization of the flow chart into a logic that would eventually be helpful in the design of the chatbot.

After finalizing the conversational flow using Miro, the computer science team moved onto the creation of the Chatbot, utilizing "Juji,"[11] a conversational bot platform that provided the infrastructure for designing and building intelligent chatbots. Currently, the chatbot is nearing completion and we are planning the soft launch within the next couple of weeks. We will disseminate the link to our online interactive platform that will host the community agents with the description of the project, the consent form, primary goals, and timeline through the contacts we have established with the town of Amherst with the local government, schools, and five colleges in the Amherst area. Once this project has unfolded, we will be able to extend this study to two other small towns nearby. The participants can choose to engage with the community agents and provide data for as long as they choose, and they can stop participation at any time. After the completion of the data collection phase, the Architecture team plans to use the analyzed data for designing and building a series of interactive visualizations such as maps and diagrams of Amherst's town and its neighborhoods to help both civilians and experts visually understand and absorb the implications of the pandemic on their lives within and along with the larger built environment.

## REFLECTIONS ON THE PROCESS AND FUTURE STEPS

This paper is written at the time that the soft launch is being prepared. Provisional IRB (Institutional Review Board) has been approved, and multiple tests have been conducted to problem-solve the technical side on the computer science side. Using conversational agents to enhance the community data collection's depth and breadth can immediately benefit the residents of Amherst and surrounding areas. Collecting rich data and making it accessible enables local and state policy makers, government officials, community organizers, and residents to gain a more profound and comprehensive understanding of the Amherst community's issues, struggles, and demands in the face of the current pandemic. It can also facilitate identifying vulnerable (e.g., low-income families struggling for food), under-served, and unrepresented groups for allocation and prioritization of resources and materials.

Moreover, our outcomes, lessons learned, and insights gained from the pandemic's impact on the built environment in a small town in Massachusetts, will hopefully resonate for other small communities across the United States, extending the impacts of our work to a much broader scale. Eventually, we hope to implement/make accessible our multi-agent chatbot system on a national level as a tool to decode just how deeply the pandemic has transformed our collective attitude towards our communities, our built environment, and our mobility among and within the world at large.

## NOTES

[1] U.S. Census Bureau. America: A Nation of Small Towns. May 21, 2020. https://www.census.gov/library/stories/2020/05/america-a-nation-of-small-towns.html.
[2] Aimee Whittington. “Farmers’ Markets as Community Social Hubs.” Amherst Farmers’ Market. January 24, 2022. http://www.amherstfarmersmarket.com/marketblog.
[3] Jim Russell, “Amherst plan to vaccinate homebound using ambulance service begins.” MassLive. March 5, 2021, https://www.masslive.com/news/2021/03/amherst-plan-to-vaccinate-homebound-using-ambulance-service-begins.html.
[4] Scott Merzbach, “Amherst school library keep the books coming for homebound students.” Daily Hampshire Gazette. October, 26, 2020. https://www.gazettenet.com/Amherst-school-librarians-make-book-home-deliveries-36946907.
[5] Eliza Shapiro and Gabriela Bhaskar. “How One N.Y.C. Teen Navigated the Pandemic and Made It to Her Senior Year.” The New York Times. November 23, 2021, https://www.nytimes.com/interactive/2021/11/22/nyregion/nyc-high-school-senior-covid.html.
[6] Anemona Hartocollis, “Another Surge in the Virus Has Colleges Fearing a Mental Health Crisis.” The New York Times, December 22, 2021. https://www.nytimes.com/2021/12/22/us/covid-college-mental-health-suicide.html.
[7] Stephanie Saul, “For many college students, pandemic life is disappointing. For others, it is a financial crisis. The New York Times. March 31, 2021, https://www.nytimes.com/2021/03/30/world/college-students-economic-struggle.html
[8] Sarah Mervosh, “The Pandemic Hurt These Students the Most.” The New York Times. July 28, 2021, https://www.nytimes.com/2021/07/28/us/covid-schools-at-home-learning-study.html
[9] Narges Mahyar, et al. “CommunityCrit: Inviting the Public to Improve and Evaluate Urban Design Ideas Through MicroActivities.” In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI ’18). ACM, New York, NY, USA, Article 195, 14 pages. February, 2018. DOI:http://dx.doi.org/10.1145/ 3173574.3173769
[10] “Miro: The online collaborative whiteboard platform to bring teams together, anytime, anywhere.” February 2020, https://miro.com.
[11] “Juji: Cognitive AI Assistants. A Workforce without limits.” February 2020, https://juji.io.

## BIBLIOGRAPHY

Hartocollis, Anemona. “Another Surge in the Virus Has Colleges Fearing a Mental Health Crisis.” The New York Times, December 22, 2021. https://www.nytimes.com/2021/12/22/us/covid-college-mental-health-suicide.html

“Juji: Cognitive AI Assistants. A Workforce without limits.” February 2020, https://juji.io.

Mahyar, Narges, Michael R. James, Michelle M. Ng, Reginald A. Wu, and Steven P. Dow. “CommunityCrit: Inviting the Public to Improve and Evaluate Urban Design Ideas Through MicroActivities.” In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI ’18). ACM, New York, NY, USA, Article 195, 14 pages. February, 2018. DOI:http://dx.doi.org/10.1145/ 3173574.3173769

Mervosh, Sarah. “The Pandemic Hurt These Students the Most.” The New York Times. July 28, 2021. https://www.nytimes.com/2021/07/28/us/covid-schools-at-home-learning-study.html

Merzbach, Scott. “Amherst school library keep the books coming for homebound students.” Daily Hampshire Gazette. October, 26, 2020. https://www.gazettenet.com/Amherst-school-librarians-make-book-home-deliveries-36946907

“Miro: The online collaborative whiteboard platform to bring teams together, anytime, anywhere.” February 2020. https://miro.com

Russel, Jim. “Amherst plan to vaccinate homebound using ambulance service begins.” MassLive. March 5, 2021. https://www.masslive.com/news/2021/03/amherst-plan-to-vaccinate-homebound-using-ambulance-service-begins.html

Saul, Stephanie. “For many college students, pandemic life is disappointing. For others, it is a financial crisis.” The New York Times. March 31, 2021. https://www.nytimes.com/2021/03/30/world/college-students-economic-struggle.html

Shapiro, Eliza and Gabriela Bhaskar. “How One N.Y.C. Teen Navigated the Pandemic and Made It to Her Senior Year.” The New York Times. November 23, 2021. https://www.nytimes.com/interactive/2021/11/22/nyregion/nyc-high-school-senior-covid.html

U.S. Census Bureau. America: A Nation of Small Towns. May 21, 2020. https://www.census.gov/library/stories/2020/05/america-a-nation-of-small-towns.html

Whittington, Aimee. “Farmers’ Markets as Community Social Hubs.” Amherst Farmers’ Market. January 24, 2022. http://www.amherstfarmersmarket.com/marketblog.

# THE MAGGIE'S CENTRE, WHERE DESIGN IS VITAL TO CREATE WELLBEING

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## INTRODUCTION

In the pre-Covid era, we underestimated how fundamental human interaction was for our psychological wellbeing. Over the past couple of years, social distancing and virtual meetings have drained social relationships and created solitude, making us realise that we still need human interaction and the physical environment. Within healthcare, where solitude and depersonalised environments are often the norm, since 1996 Maggie's has been offering practical and psychological support to people with cancer in the UK and abroad, bringing the human element back to the centre, making people feel as individuals. In an attempt to understand what generates wellbeing within Maggie's compared to other healthcare facilities, what emerged from the research is that basic human needs are always the same: *feeling valued, feeling at home, feeling included*. In particular, the last principle, "inclusiveness", is of primary importance to counteract solitude. At Maggie's, a design brief that requires an open and boundless space with a "kitchen table" at its centre that unites staff and "visitors" (as equally are considered people with cancer, their families and friends), is essential to create an environment of total sharing. In UK institutions that offer health services, this condition never occurs. There is, in fact, no circumstance in which the "staff room" is deliberately excluded from the design brief, thus preventing the staff from being able to separate from the users. This key factor, which sets Maggie's apart from all other organisations, should inspire us all. Teaching us that human-centred design can generate an ideal and caring community like that of Maggie's, the open and boundless space becomes the generating principle of the personalised and inclusive experience that allows wellbeing.

### Maggie's essence

The Maggie's centre was founded in Edinburgh in 1995 by Maggie Keswick and her husband Charles Jencks, both landscape architects and designers. Anti-institutional, with a domestic feel and a 'hybrid nature' - a little bit of a hospital, of a house, of a church, and of a museum and the opposite of all this[1] - Maggie's helps visitors navigate the complexity of traumatic transition in a unique way. Distinguishing itself amongst hospitals for its unconventional design, which is a requirement of the programme and one of the reasons for its success, the architecture of the building tells users that "Maggie's is their home and they are in charge"[2]. This philosophy is based on the belief that "design is a form of care" and the motto "empower the patient" through a "self-help" strategy, central to Maggie's open psychological support programme. Thanks to this combination, at Maggie's people

traumatised by a cancer diagnosis develop a flexible state of mind and, finding the strength to react, come to accept the disease, something intolerable before. Indeed, the sense of calm, control and safety that they feel inside a Maggie's centre are the expression of a state of physical and emotional wellbeing[3].

### Maggie's Power of Architecture

The current twenty-nine Maggie's centers existing in the UK and abroad, aiming to grow with new buildings under construction or in the planning stage, are always built alongside the hospital, next to the Oncology Unit. Being in the perimeter of the hospital, the proximity to the clinical environment creates a great contrast between the large hospital complex and the tiny Maggie's, which, while supporting the medical activity, maintains a strong autonomy and a clear identity. Unleashing a force that spreads into the surrounding environment, Maggie's unconventional, sometimes provocative architecture intrigues and shakes and, challenging the hospital, demonstrates how what was once a "non-place" can become a "place", representing an extraordinary case of the power of architecture. However, in the difficult task of affecting the design of the hospital, beyond the physical and aesthetic opposition, that of Maggie's is above all a cultural challenge that urges the NHS to react to the accepted *status quo* of the health environment as a whole.

#### Maggie's Brief

The most obvious feature of the Maggie's centre is that it does not look like a health facility, while the most surprising is that Maggie's centres are all different yet they all communicate the same feelings. Both features derive from the Architectural Brief[4], the programme written shortly after Maggie's death from breast cancer in 1995, and following the construction of Maggie's Edinburgh, designed by Richard Murphy. Completed in 1996, according to Maggie's ideas the centre was to be like a house with a kitchen table in the centre, where people could chat over a cup of tea. Very different from any other Brief, the synthetic Maggie's Brief, which has remained unchanged over time, does not prescribe technical solutions, but requires spaces that allow users to experience a variety of feelings. In response to the Brief, by providing a "menu" of spaces accessible to all, where people can find the space suitable for the emotion of the moment, the architects are free to interpret the indications at will. This freedom derives from the "little said" of the Brief which alone constitutes the way in which the client, Laura Lee, achieves her goal: paradoxically, by letting the architect free to read the "white space between the lines" she obtains that reference and wisdom that will be transferred to the feelings and emotions that the building should evoke. In its essence, the Architectural Brief is the hidden recipe for Maggie's success.

## DELIVERY OF HEALTHCARE

The way healthcare is provided in a hospital or any healthcare facility today is very different than it once was. Due to the introduction of "machines" and "protocols", which limit healing to the body and exclude the mind, health care has become a mechanistic healing versus a therapeutic one, that used to include nature and beauty. In an attempt to recompose 'architecture' with 'therapeutic', reminding us that, traditionally, "pain and disease have inspired art and architecture", the Maggie's centre is "a cocktail, the necessary relationship between the social and the physical, the spiritual and the painful, the service and the architectural setting"[5].

### Greeks

In healthcare, cooperation between architecture and people is not new. For more than eight centuries, the ancient Greeks offered healing, uniting *therapeutes* and *invalids* in magnificent buildings with splendid scenarios rich in vegetation and spectacular views. In the search for the connection between

the *architecture* and *flexibility*, in his book "A Place of Healing"[6], Kearney tells about the ancient healing complex of Asclepius and how, by moving between library, theatre and stadium, therapists and sick worked together along a path of healing in suffering. "Asklepian healing depends on both patients and carers using the 'inner senses' of emotion, instinct, intuition, and somatic awareness"[7]. The term therapy, from the Greek *therapeia* (= service, attendance), and from *theraps* (= attendant), for the Greek worshipers of God Asclepius, in fact, indicated not so much the medical treatment, but above all participation, "the compassionate and caring attitude of those who attend them and stay with them in suffering"[8]. Evident in the synergy of movements performed before the temple by therapists and patients creating a "fluid dance", this combination was what generated the flexible state of mind in patients and carers, helping them to find harmony, balance and personal development in the struggle.

### Hospital context

In healthcare architecture, usually staff and patients use the building in an antithetical way, receiving an opposite experience and perception, very often both of dissatisfaction. As reported by Maggie's staff formerly working for the NHS, the hospital is very limited in terms of space and is always very busy and noisy and everybody rushes. This is why the hospital provides the staff with a "staff station", where to rest far away from patients. Providing an organisation with a staff station means characterising it with the 'segregation' of staff from patients which, especially in the healthcare sector, means treating patients as something "less" or "other".

It's what I call the 'othering', they are different; so why are you eating somewhere else? Shouldn't we eat together? If you have a caregiver in your house that caregiver has dinner with you, that caregiver prepares dinner and you eat together[9].

Also, when it comes to locating the "staff station" in the floor plan, hospital designers often relegate it to the darkest building. Unbearable for the staff who see it as a "sluice" where burnout hospital workers go "to cry"[10], the habitable conditions of these rooms – normally without natural light and ventilation - necessarily negatively affect the mind and behaviour of the staff with equally negative consequences on the relationship with patients. Considering that over the past year, driven by the increase in donations from private and public due to Covid, hospitals across the UK have invested a significant amount of money in 'building' new spaces to improve staff wellbeing to "unwind", "destress" and "relax", this situation is quite paradoxical. Sometimes "the workplace was so inhospitable, that staff were already being exposed to physical/psychological stresses even before considering the demands of the job"[11]. By way of example, this demonstrates that even the best-intentioned design that in a Maggie's centre creates regenerative environments is simultaneously capable of creating environmental stressors that contribute to work pressure and high burnout rates, if not guided by a proper architectural brief. Making the hospital of the future aware that safeguarding staff through 'segregation' and investing money in 'building' wellbeing does not automatically make people feel good, Maggie's teaches us that only a human-centered design brief makes people *feel valued, at home and included*.

## MAGGIE'S DESIGN PRINCIPLES

The design principles established by the Architectural Brief are included in the few pages of the document, which, as mentioned, was already inherent in the project of Maggie's Edinburgh (1996). By not providing information counters or clinical signs in the building, Murphy created an unconventional and uncommon type of healthcare facility. In addition, by providing a large open kitchen quite close to the front door, the Scottish architect allowed those who entered to feel immediately at home. Finally, by combining the kitchen area with the open staircase and surrounding

spaces, always in contact with nature, and completely banishing the corridors, Murphy has established an unprecedented architectural archetype of "spatial interaction rather than walls". This spatial continuity is the starting point of the sequence of spaces and functions that unite people by enabling in them that flexible state of mind that allow them to find ways to tolerate what was intolerable before.

### Unconventionality

To make people *feel valued*, the Architectural Brief requires an unconventional architecture with welcoming areas to sit and observe art and nature that at Maggie's are of value and importance. By stimulating their senses, Maggie's unconventionality and scenography help visitors be present and aware, nurturing the bond between the body and the surrounding space. The concept that the built environment influences our behaviour is evident in the performance that Maggie's puts on every day, which, in a thoughtful way, makes its users feel like actors. n the large kitchen, unconventional for a health facility, during the tea-making ritual, people follow a familiar script, in which all the actors know their part, because "everyone knows what to do in the kitchen". By preparing their drinks alone, a sense of control begins to arise in new visitors making them feel valued.

### Familiarity

In contrast to the aseptic environment of the hospital, the Architectural Brief had established from the start that the Maggie's centre made people *feel at home*. Far from being conventional, the familiar environment of the kitchen is the place where good humor and joy of living are released every day. At Maggie's, unregistered, visitors are free to enter and feel at home accessing any part of the building, participating in group activities, reading a book in a corner alone or being in the company of other visitors around the kitchen table. The philosophy of "kitchenism" - a serious joke coined by Charles Jencks - expressing colloquiality and good humour, allows people to find the best way to feel comfortable before fully engaging with the centre: simply offering a cup of tea helps facilitate socialisation[12].

### Openness

To *feel included*, the Architectural Brief requires open spaces, so visitors move easily and are always in visual and sonar contact. Depending on the mood of the person, people seeking social interaction will be attracted by kitchen; if, instead, they want a quieter environment, they will head to a secluded space such as the library or garden. For new visitors, who will be hosted in the welcome area to feel reassured that they can leave at any time, the openness surprises and makes them feel a little anxious to be observed. However, it is precisely the open space that allows people compensate for the fears of the first moment, resonating with the emotions of others. This feeling is called "empathy", which is our ability to share compassion and help. The observation that in monkeys mirror neurons are activated not only when they perform an action but also when they see another monkey perform the same action suggested a group of neuroscientists from Parma (Italy) that human action is the consequence of a visible, understandable and therefore imitable intention[13]. Mirror neurons activate the interchangeability of points of view and the sharing of the other's feelings, so we can see what the other sees, hears or feels. Through empathy, the relationship with the "other" is a relationship of similarity ("I'm just like me") of which an important component is the common experience of action (sharing at the kitchen table). This fact is very important in a Maggie's centre, where thanks to the open space people can observe others and, gaining confidence, think "if others do it, I can do it too"[14]. Observing others, the "spatial interaction rather than walls" fires the mirror neurons of people with cancer who, begin to imitate and, activating a chain reaction, start the healing process.

### Human centrality, the fourth ingredient

As discussed during my interview with Maggie's architects, those who enter the hospital today certainly do not have the impression that architecture and design are a priority, as care is masked by a mechanistic system. On the contrary, those who enter a Maggie's centre immediately receive the clear message that the human dimension is central and Maggie's goal is the loving care of the person highlighted by the way in which the staff express total dedication to visitors. Despite the opposite health conditions between the two, living and doing everything together, staff and visitors appear similar, to the point that it is sometimes difficult to recognise who is sick and those who are not. The fact that Maggie's Brief does not provide off-limits rooms, much less requires a "staff station" automatically helps keep staff and visitors together at the kitchen table, participating in the daily stories and sharing feelings and emotions. Compared to the hospital, visitors are more relaxed also because the staff do not wear a uniform as a barrier and have the ability to make everyone feel calm and relaxed, although sometimes is hectic and requires a lot of effort. In this, they say, the building helps a lot to keep calm.

It makes you feel relaxed and you could always find a space to reflect and collect your thoughts. It is truly the synergy of a powerful and beautiful building and the ability of the human being interacting in that space. (Maggie's Barts Centre Head, 2019)

## CONCLUSION

In the footsteps of the Greek-Asclepian therapeutic environment that united therapists and patients to move together and "participate", at Maggie's the space unites users, supporting the staff in their work of assisting visitors in a personalised way. Allowing for an inclusive experience, at Maggie's the Architectural Brief, concise and with "little said", requiring "kitchen tables" rather than "staff stations", as well as unconventionality, familiarity, openness and human-centrality is also essential to make people feel like individuals. If the "hospital of the future" continues to heal by acting on the body through machines, by moving the human more towards the centre, it will also be able to offer beauty and values through an architecture that integrates. After two years of social distancing and virtual meetings, inclusiveness, necessary in this historical moment, could also help to move architecture beyond the rigid digitalised system that has become the current discipline, bringing attention back to feelings and emotions.

## NOTES

[1] Charles Jencks, *The Architecture of Hope: Maggie's cancer caring centres* (London: Frances Lincoln, 2015), 7.
[2] Laura Lee, Lee, Video presenting the Maggie's Centre. V&A, Dundee.
[3] Maggie's Evidence (2015) Maggie's Evidence-based_Programme Web Spreads. Available at: https://maggies-staging.s3.amazonaws.com/media/filer_public/78/3e/783ef1ba-cd5b-471c-b04f-1fe25095406d/evidence-based_programme_web_spreads.pdf (Accessed: 15 March 2022).
[4] Maggie's Brief (2015) *Architectural and Landscape Brief*. Available at: https://maggies-staging.s3.amazonaws.com/media/filer_public/e0/3e/e03e8b60-ecc7-4ec7-95a1-18d9f9c4e7c9/maggies_architecturalbrief_2015.pdf (Accessed: 15 March 2022).
[5] Charles Jencks, *The Architecture of Hope: Maggie's cancer caring centres* (London: Frances Lincoln, 2015), 13-14.
[6] Michael Kearney, A place of healing (New Orleans: Spring Journal, Inc. 2009).
[7] Kearney., 46.
[8] Kearney., xxii.
[9] 'Patterns of Neurons Firing'. Interview with Sabina Brennan. Interviewed by N. McLaughlin and Y. Manolopoulou for Losing Myself, (2015), 45:30. Accessed: 15 March 2022. Available at: http://www.losingmyself.ie/pages/patterns-neurons-firing/
[10] Rebecca Williams, "Crying in the sluice": Environmental contributions to burnout in hospital workers in "Environments By Design: Health Wellbeing And Place", Amps Conference, December 12-15. Available at: https://amps-research.com/wp-content/uploads/2021/11/Rebecca_Williams_-Environmental_contributions_to_burnout_in_hospital_workers_Abstract_Health-2021.pdf (Accessed: 15 March 2022).
[11] Williams., 1
[12] Charles Jencks and Edwin Heathcote, *The Architecture of Hope: Maggie's cancer caring centres* (London: Frances Lincoln, 2010), 13.
[13] Vittorio Gallese, "Corpo vivo, simulazione incarnata e intersoggettività: Una prospettiva neurofenomenologica", in *Neurofenomenologia Le Scienze della Mente*, ed. Massimiliano Cappuccio, (Milan: Mondadori, 2006), 293-326.
[14] Lesley Howells, *Synergy between people and place* (TEDx Talks, June 8, 2016, 8:30 am), accessed 15 March 2022. https://www.youtube.com/watch?v=tvE78D30CbQ .

## BIBLIOGRAPHY

Eberhard, John P. "Applying neuroscience to architecture." Neuroview, 62(6) (2009): 753-56.
Gepshtein, Sergei and Berger, Tatiana. "Dynamics of Architectural Experience In The Perceptual Field'. In AMPS Proceedings Series 18.1. Experiential Design – Rethinking relations between people, objects and environments, edited by Yelena McLane, and Jill Pable, 83-94, Florida State University, 16 – 17 January, 2020.
Jencks, Charles. The Architecture of Hope: Maggie's cancer caring centres. London: Frances Lincoln, 2010.
Jencks, Charles and Heathcote, Edwin. The Architecture of Hope: Maggie's cancer caring centres. London: Frances Lincoln, 2010.
Vittorio, Gallese. "Corpo vivo, simulazione incarnata e intersoggettività: Una prospettiva neurofenomenologica." In *Neurofenomenologia Le Scienze della Mente*, edited by Massimiliano Cappuccio, 293-326. "Milan: Mondadori, 2006.
Kearney, Michael. A place of healing. New Orleans: Spring Journal, Inc., 2009.
Martin, Darryl, Nettleton, Sarah. and Buse Christina. "Affecting Care: Maggie's Centres and The Orchestration Of Architectural Atmospheres." Social Science & Medicine, 240, (2019): 1-8.
Rizzolatti, Giacomo, Fadiga, Luciano, Fogassi, Leonardo, Gallese Vittorio. "Premotor cortex and the recognition of motor actions." Cogn. Brain Res., 3(2), (1996): 131-41.
Stein, Edith. On the Problem of Empathy (Waltraut Stein, trans.). The Hague: Martinus Nijhoff. (1917) 1964.
Williams, Rebecca. "'Crying in the sluice': Environmental contributions to burnout in hospital workers". In Amps Proceedings in "Environments By Design: Health Wellbeing And Place." Abstract presented in the Amps

Conference, with Syracuse University, Northumbria University, The Italian Society for the Sociology of Health, Chalmers University of Technology, (Online), December 12-15, 2021.

# ENERGY-RETROFITTING MIGHT BE GOOD FOR THE ENVIRONMENT, BUT WHAT ABOUT THE INDOOR ENVIRONMENT?

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## INTRODUCTION

When energy-retrofitting your house, you might do something good for the environment, but recent research shows that what is beneficial for the environment and the private economy is not necessarily beneficial for the indoor environment. Danish surveys reveal that both new houses and energy-retrofitted houses have problems in terms of overheating in summer. Increased ventilation seems to be the answer, but mechanical ventilation will create further energy use, so what is the solution and could it be passive?

### The indoor environment is facing new problems

In recent years the initiatives to improve the indoor environment of Danish buildings have been targeted such as schools and offices, whereas private homes have been offered less attention. Today, Danes spend on average between 80-90% of their time indoors and an average of 16 hours a day is spent within the home.[1] Hence, the indoor environment of our homes is of utmost importance to our health and well-being. Add to that the recent tendency among Danes to work from home as a result of the COVID19 pandemic – a tendency that according to investigations by the Danish pension company PFA Pension is going to continue in the future, which will strain the indoor environment of our homes further.[2]

In contemporary Danish building and renovation practices, the energy consumption of houses is a major focus. However, it has been shown that a significant energy reduction entails new challenges regarding thermal comfort. A survey by the Danish foundation Realdania shows that houses built before 2000 typically have problems with draught and cold, whereas houses built after 2000 tend to have the opposite problem – overheating.[3] Overheating is also a significant problem in energy-retrofitted houses, where it usually occurs due to a highly sealed, insulated facade. According to the Danish Energy Agency, this is a consequence in 22% of energy retrofitted detached houses in Denmark.[4]

Initially, this paper explores the current indoor environmental issues in new and energy-retrofitted detached houses with a special focus on thermal comfort. It then examines existing research and literature on passive solutions and with references to architecture researchers Signe Kongebro and Bjørn Berge as well as the Danish building experiment *the Breathable House* (*Det Åndbare Hus*) the potentials of passive solutions are discussed. Finally, the paper suggests one specific passive solution that can be activated through renovation to optimize ventilation and improve the indoor environment.

The paper focuses on Danish detached houses from the 20th century as they are most likely next in line for energy retrofitting. More than half of the Danish population lives in detached houses, which makes it the most prevalent type of dwelling. They are similarly responsible for the majority of the heat consumption of the building mass.[5] Furthermore, 35% of Danish housing was built before 1980 and therefore they generally do not meet the first actual energy requirements introduced in 1979.[6] However, many of the detached houses from that time have great architectural qualities and form a good foundation for renovation as opposed to demolition and rebuilding.

While energy-retrofitting can alleviate some problems with the indoor environment, it has simultaneously introduced new challenges with the indoor environment and thermal comfort. The Danish building regulation demands high standards for energy efficiency when renovating, which results in tightly sealed building facades, but according to the research project *Healthy Houses Renovation* by Realdania, insulating and installing new windows without improving the ventilation system of the house can cause negative consequences in terms of indoor environment.[7] These actions will lead to a decrease in the natural airflow through cracks and leaks, which is obviously the purpose of energy-retrofitting – it takes much more energy to heat the indoor air when you have an uncontrolled airflow through the house. The problem, however, occurs when the former natural ventilation of the house is not replaced by another kind of ventilation. The lack of ventilation leads to increased concentrations of $CO^2$ and humidity, which is not only damaging to the construction of the house but also the health of the occupants.[8] The solution suggested by Realdania's research project is a mechanical ventilation system, and it is argued that although we need to be mindful about energy use, energy is required to properly ventilate our homes[9]

The energy use of mechanical ventilation is partially outweighed if the system contains heat recovery – a way to heat the fresh air with the stale hot air before it enters the house. The Danish building regulation requires that mechanical ventilation systems are supplied with heat recovery – a requirement that is not just applicable for new buildings but also for large renovations.[10] Though the building regulation holds strict requirements for ventilation with heat recovery, the energy use for ventilation systems still constitutes a large proportion of the total energy use in Denmark.[11]

## Passive energy solutions

The *passive house* concept has proven that it is possible to gain large reductions in the energy use of housing due to so-called *passive energy solutions*, for instance, natural ventilation, which saves energy for ventilation and cooling.[12] These solutions minimize the need for technical systems and are efficient throughout the lifetime of a building because they are an integrated part of the building design.[13] Research shows that passive solutions can be utilized in terms of heating, cooling and ventilation, which means that they are also capable of controlling the indoor environment.[14] Even though the focus on the indoor environment has increased in recent years, passive solutions have so far only been targeted at energy saving. This means that great potential lies in investigating how passive solutions can improve the indoor environment.

According to Signe Kongebro, founder of the sustainability department at Henning Larsen Architects, poorly designed buildings often require more energy than usual to create an acceptable indoor environment, and she adds that the massive need for mechanical ventilation could be reduced if instead the climatic conditions of the building were integrated as part of the design from the beginning.[15] She argues that this would be economically beneficial in the construction phase as well as in the operating phase and that it would result in better buildings with higher ceiling heights and less noise from ventilation systems.[16] Furthermore, she problematizes that often when it comes to the indoor environment, the only goal is to reach a certain stable temperature, which is done automatically without any interaction from the occupants. Ideally, she says, the occupants should be able to interact

with the building to create a suitable indoor environment. Being able to open a window or control the sun shading increases the self-determination of the occupants and research shows that a feeling of self-determination makes occupants accept fluctuating temperatures and luminosity.[17] These variations in the indoor environment may even be a pleasant break from otherwise stable temperatures and light settings.

According to architect and researcher Bjørn Berge, the author of the book *The Last Sick Buildings* (*De siste syke hus*), there is no such thing as distancing oneself from the indoor environment. As long as we are inside a building, we interact with it. He describes how the building functions as a third skin – an addition to the skin of the body and the clothes we wear.[18] Our clothing and our houses can be seen as extensions to our body's skin and Berge argues that these serve the same task as the skin on our body – that is regulation of humidity and temperature and protection against physical and chemical influences. These three types of skin protect us from the forces of nature. However, a problem occurs when the house no longer protects us but instead works against the organism of the body.[19] Berge describes how a new palette of materials, installations and ways of building, introduced since the 1960s, has influenced our health and wellbeing negatively. The consequences can be mild symptoms such as dry skin, tiredness and headaches, whereas some of the more serious consequences count diseases such as migraine, allergies, asthma or even cancer.[20] Pollution of the outdoor and the indoor air has caused what Berge calls *the 20th-century syndrome* – a tendency of allergic reactions to a variety of influences. He explains how allergies among the population of Western Europe has increased from 1% in the 50s and 60s to 15-30% of the population in the late 80s when the book was written.[21] As a comparison, the number of people who suffer from allergies in Denmark has increased from 7-8% in the 70s to 24% today.

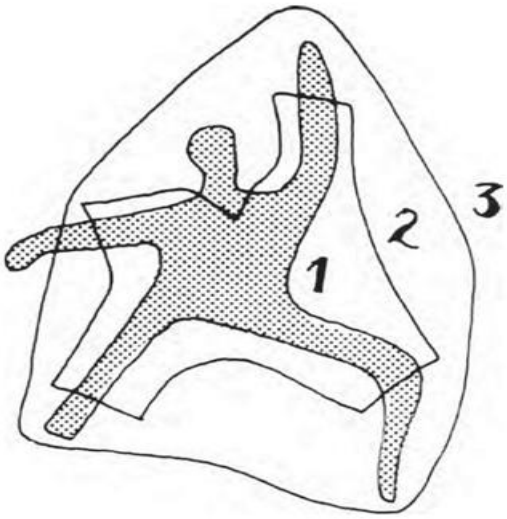


*Figure 1. Buildings as the third skin. Illustration by Bjørn Berge, The Last Sick Buildings (De siste syke hus).*

## The Breathable House

The case in which a house or parts of a house are conflicting with the natural processes of the body and cause the livelihood of diseases has gradually become well known within building industries. The phenomenon is called *sick building syndrome* and is best known from large office buildings and apartment blocks. Already in 1988, Bjørn Berge takes up the phenomenon as a mystery, because at that time it was almost impossible to link the symptoms of the occupants directly to specific sources.[22] Still, he claims, there are ways to "heal" a sick house. One way is to purify the air, another is to

increase the amount of ventilation and the third is to renovate the house. Additionally, there are two practices when renovating a sick house; either replacing the polluting elements or sealing them and in that way avoiding further spreading of pollutants.[23]

In new buildings, there are of course more possibilities of impacting the indoor environment from the very beginning and thus it gives opportunities of creating a building that works together with the body. Berge introduces *the ecocycle house*; the embodiment of the house as the third skin – a house that supports the biological processes and rhythms of the body, such as breathing, balancing of temperatures, regulation of moisture and decomposition of indoor pollutants. Berge describes the ecocycle house as an organism, which is open and connected to the cycles of nature – in opposition to houses with vapour barriers that block out other outer elements than the ones taken in by close control of the mechanical ventilation system. What is needed to create such a house, he says, is materials rich on pores and open surfaces together with knowledge of the physical and chemical abilities of air, water and sunlight.[24]

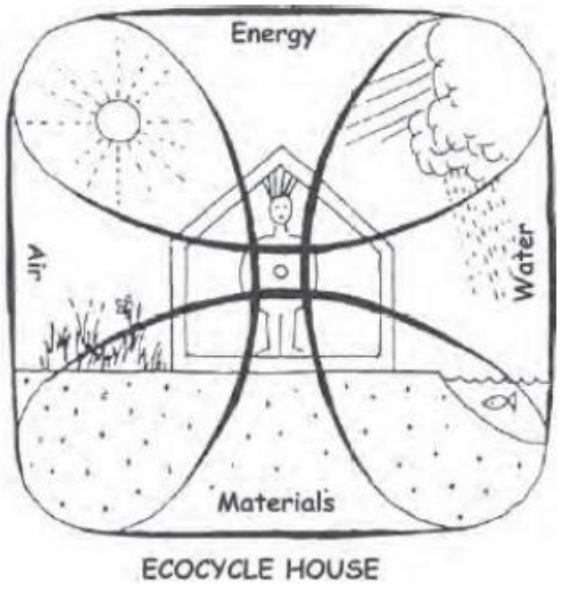


*Figure 2. Ecocycle House. Illustration by Bjørn Berge, The Last Sick Buildings (De siste syke hus).*

Outside the city of Ringsted, a Danish version of the ecocycle house has been built by the company *Egen Vinding og Datter* that develops sustainable and ecological building methods. It is a building experiment, called *the breathable house*, supported by the Ministry of Environment of Denmark with the aim of testing whether it is possible to create a good indoor environment and at the same time secure the lowest possible environmental impact.[25] The house is built of natural materials, with a thatched roof, facades of wood, inner walls and floors of unburnt clay and the insulation is made of paper, linen and hemp – all materials capable of transporting moisture. The ventilation happens through valves in the windows that preheat the fresh air before it enters the rooms and a solar chimney placed in the middle of the house, which leads the stale air away utilizing thermal buoyancy.[26] The experimental house follows the restrictions of airtightness in Danish building regulation, but since the materials used allow diffusion of moisture, no external mechanical ventilation system is needed.[27]


*Figure 3. The Breathable House. Photo and illustration by Egen Vinding og Datter and House Arkitekter.*

## Reusable passive solutions

Not nearly all of the solutions from the breathable house are applicable when it comes to renovation, but there might still be an inspiration to find that can help improve the indoor environment of an existing house. If we take a look at the most common problems with the indoor environment of houses in Denmark built before 1979, we see that cold, draught, moist, mould and cold walls are the greatest challenges.[28] When it comes to detached houses one of the disadvantages is that they have a relatively big surface area compared to the total floor area, which means that it requires equally much energy to heat them and maintain an acceptable indoor temperature. At the same time, energy-retrofitting that includes sealing and re-insulating the facades could potentially result in problems in terms of overheating.

However, the challenges of overheating and lack of ventilation in detached houses may have a natural - and even passive – solution. Most Danish houses built before 1979 have chimneys, but recently a new law was effectuated, which demands that burning stoves from before 2003 are replaced when a house is sold.[29] The law is an attempt to minimize particle pollution and improve the indoor air in Danish homes. Burning stoves discharge particles that are damaging to our health and can result in coronary heart diseases and respiratory diseases.[30] In 2003 a new European standard was released, which tightened the requirements for particle emissions from burning stoves. This means that burning stoves produced after 2003 discharge 70% fewer particles than older ones.[31] This also means that many burning stoves are now removed, which leaves a great number of unused chimneys behind. It might be tempting to simply tear down the chimney, but the chimney plays an important role in the ventilation of the house.

Bjørn Berge explains how furnace heating used to be a common way of heating houses until the 40s and that it required a significant air supply, which simultaneously caused a change of air within the house due to cracks and leaks in the facade. Furthermore, ventilation channels were often lead along with the chimney and this combination of smoke channels and ventilation channels alongside each other created an optimal buoyancy and outlet for stale air.[32] Today we neither want the particles from the furnace, nor the cracks and leaks in the facades, but that doesn't necessarily mean that the chimney has become obsolete. As we see in the example of *the breathable house*, a chimney that has never been connected to a furnace or stove secures the ventilation of the house due to the principle of a solar chimney. The top of the solar chimney works as a thermal mass and is surrounded by a glass box with an openable window. The chimney is heated by the sun during the day, which creates the necessary buoyancy for the hot and stale air to leave the house through the chimney. The fresh air

enters through ventilation windows, which controls the intake of air and preheat it on the way in, and the polluted air from kitchen and bathroom leaves via the chimney itself, while the rest of the stale air is removed via the opening in the glass box.

*Figure 4. The solar chimney in the Breathable House. Photos by Egen Vinding og Datter/House Arkitekter.*

The solar chimney in the breathable house is purposely built for ventilating the home, which may not be the case for most chimneys in existing houses, where they have primarily served as part of the heating system. But perhaps there is the potential for the chimney to take on a new role. Is there any opportunity within renovation to rethink the chimney as part of an improved ventilation system: An alternative to mechanical ventilation that is simultaneously beneficial for the environment *and* the indoor environment?

## CONCLUSION

Danish detached houses are facing new challenges in terms of overheating as a result of energy-retrofitting – a problem that needs attention and new ways of renovating. This calls for improved ventilation, but the tendency seems to be increasing the number of mechanical ventilation systems, which require further energy to run, and the question is: Is this extra energy consumption necessary, or do passive solutions have an untapped potential that could be utilized? In new houses, there is a possibility to integrate passive solutions such as natural ventilation from the very beginning, but when renovating existing houses the choices are limited. However, a solution to the problems of overheating and lack of ventilation could lie in an existing architectural element, which already exists in most detached houses built before 1980. This paper instigates the preservation and reuse of the chimney as an integrated element in a passive ventilation system – a reinvention of what has been a crucial part of its functioning for centuries. Further studies on *how* chimneys can be transformed to optimize the natural ventilation of detached houses will be the next step towards an improved indoor environment.

## NOTES

[1] Maja Skovgaard, et.al. *Indeklima og sundhed i boliger : resultater og gode råd til et sundere indeklima fra forskningssamarbejdet CISBO til byg- og driftsherrer, rådgivere i byggeriet, sundhedspersonale og beboere*, ed. Maja Skovgaard et.al. (Aarhus, Kbh.: CISBO, 2016), 6.
[2] Martin Keiding, "Leder: Bygningsprogrammering som værnemiddel", Arkitekten 7, September 2020, 1 https://arkitektforeningen.dk/arkitekten/leder-bygningsprogrammering-som-vaernemiddel/
[3] "Danskerne i det byggede miljø : en spørgeskemaundersøgelse", Realdania and Bolius, (København, Ballerup: Realdania, 2021), 61, https://realdania.dk/publikationer/faglige-publikationer/danskerne-i-det-byggede-milj%C3%B8.
[4] "Sammenhængen mellem boligers energistandard og komfort - Interviewundersøgelse", Energistyrelsen and Niras,
(København: Energistyrelsen, 2015), 26.
[5] Rob Marsh, Signe Kongebro, and Lise Mansfeldt Faurbjerg, *Arkitektur, energi, renovering : designguide for energi-, dagslys- & indeklimarenovering*, 1. udgave (Kbh.: Statens Byggeforskningsinstitut, 2013), 9.
[6] "Byggeriets energianalyse", Dansk Byggeri, (København: Dansk Byggeri, 2019), 15, https://www.danskbyggeri.dk/media/37418/klausuleret-byggeriets-energianalyse_2019_samlet.pdf.
[7] Frederik Buhl Kristensen, "Nyt Realdania-projekt: Energirenovering kan medføre decideret sundhedsskadeligt indeklima", Byrummonitor, November 1, 2019,
https://byrummonitor.dk/Nyheder/art7456984/%C2%BBEnergirenovering-kan-medf%C3%B8re-decideret-sundhedsskadeligt-indeklima%C2%AB.
[8] Kristensen.
[9] Kristensen.
[10] "Guide Til Ventilation i Enfamiliehuse", Videncenter for Energibesparelser i Bygninger, (2017), 5, https://docplayer.dk/68672833-Guide-til-ventilation-i-enfamiliehuse-guide-nyhedsbrev.html.
[11] Claus M. Hvenegaard and Christian Drivsholm *Den lille blå om ventilation*, ed. Jørn Borup Jensen, Dorte Lindholm, and Ditte Mikkelsen, 3. udgave (Frederiksberg: Dansk Energi, 2016), 8.
[12] "Lavenergihuse Og Passivhuse," Bolius, accessed January 10, 2022, https://www.bolius.dk/lavenergihuse-og-passivhuse-18470
[13] Signe Kongebro, ed., *Design med viden : ny forskning i bæredygtigt byggeri*, trans. Michael Jørgensen, Martin Vraa Nielsen, and Jakob Strømann-Andersen, 1. udgave (Kbh.: Henning Larsen Architects, 2012), 17.
[14] "Passivhuse", Indeklimaportalen, accessed January 10, 2022, https://www.indeklimaportalen.dk/indeklima_generelt/raadgivere/baeredygtigt-byggeri/passivhuse.
[15] Signe Kongebro, ed., *Design med viden : ny forskning i bæredygtigt byggeri*, trans. Michael Jørgensen, Martin Vraa Nielsen, and Jakob Strømann-Andersen, 1. udgave (Kbh.: Henning Larsen Architects, 2012), 43.
[16] Kongebro, 43.
[17] Kongebro, 43.
[18] Bjørn Berge, *De siste syke hus* (Oslo: Universitetsforlaget, 1988), 9.
[19] Berge,9.
[20] Berge, 10.
[21] Berge, 13.
[22] Berge, 10.
[23] Berge, 16.
[24] Berge, 17.
[25] "Det Åndbare Hus," Egen Vinding Og Datter, accessed January 17, 2022, https://egenvinding.dk/det-aandbare-hus
[26] Jette Hagensen, *Teknisk rapport - det åndbare hus* (Egen Vinding og Datter, 2019), 19, https://egenvinding.dk/sites/default/files/Teknisk%20rapport%20D%C3%85H%20september%202019%20final.pdf.
[27] "Det Åndbare Hus," Egen Vinding Og Datter, accessed January 17, 2022, https://egenvinding.dk/det-aandbare-hus
[28] "Danskerne i det byggede miljø : en spørgeskemaundersøgelse", Realdania and Bolius, (København, Ballerup: Realdania, 2021), 61, https://realdania.dk/publikationer/faglige-publikationer/danskerne-i-det-byggede-milj%C3%B8.
[29] Kim Gregersen, "Ny lov: Boligkøbere skal skifte eller skrotte den gamle brændeovn", Bolius, January 18, 2022. https://www.bolius.dk/ny-lov-boligkoebere-skal-skifte-eller-skrotte-den-gamle-braendeovn-91277.

[30] Gregersen, 91277.
[31] Gregersen, 91277.
[32] Bjørn Berge, *De siste syke hus* (Oslo: Universitetsforlaget, 1988), 114.

## BIBLIOGRAPHY


Berge, Bjørn. *De siste syke hus*. Oslo: Universitetsforlaget, 1988.

Dansk Byggeri. "Byggeriets energianalyse". København: Dansk Byggeri, 2019. https://www.danskbyggeri.dk/media/37418/klausuleret-byggeriets-energianalyse_2019_samlet.pdf.

Egen Vinding Og Datter. "Det Åndbare Hus." Accessed January 17, 2022. https://egenvinding.dk/det-aandbare-hus

Gregersen, Kim. "Ny lov: Boligkøbere skal skifte eller skrotte den gamle brændeovn". Bolius, January 18, 2022. https://www.bolius.dk/ny-lov-boligkoebere-skal-skifte-eller-skrotte-den-gamle-braendeovn-91277.

Hagensen, Jette. *Teknisk rapport - det åndbare hus*. Egen Vinding og Datter, 2019. https://egenvinding.dk/sites/default/files/Teknisk%20rapport%20D%C3%85H%20september%202019%20final.pdf.

Hvenegaard, Claus M., and Christian Drivsholm. *Den lille blå om ventilation*. Edited by Jørn Borup Jensen, Dorte Lindholm, and Ditte Mikkelsen. 3. udgave. Frederiksberg: Dansk Energi, 2016.

Indeklimaportalen. "Passivhuse". Accessed January 10, 2022, https://www.indeklimaportalen.dk/indeklima_generelt/raadgivere/baeredygtigt-byggeri/passivhuse.

Keiding, Martin. "Leder: Bygningsprogrammering som værnemiddel". Arkitekten 7, September 2020. https://arkitektforeningen.dk/arkitekten/leder-bygningsprogrammering-som-vaernemiddel/.

Kongebro, Signe, ed. *Design med viden : ny forskning i bæredygtigt byggeri*. Translated by Michael Jørgensen, Martin Vraa Nielsen, and Jakob Strømann-Andersen. 1. edition. Kbh.: Henning Larsen Architects, 2012.

Kristensen, Frederik Buhl. "Nyt Realdania-projekt: Energirenovering kan medføre decideret sundhedsskadeligt indeklima". Byrummonitor, November 1, 2019. https://byrummonitor.dk/Nyheder/art7456984/%C2%BBEnergirenovering-kan-medf%C3%B8re-decideret-sundhedsskadeligt-indeklima%C2%AB.

Marsh, Rob, Signe Kongebro, and Lise Mansfeldt Faurbjerg. *Arkitektur, energi, renovering : designguide for energi-, dagslys- & indeklimarenovering*. 1. edition. Kbh.: Statens Byggeforskningsinstitut, 2013.

Energistyrelsen and Niras. "Sammenhængen mellem boligers energistandard og komfort - Interviewundersøgelse". København: Energistyrelsen, 2015.

Realdania and Bolius. "Danskerne i det byggede miljø : en spørgeskemaundersøgelse". København, Ballerup: Realdania, 2021. https://realdania.dk/publikationer/faglige-publikationer/danskerne-i-det-byggede-milj%C3%B8.

Bolius. "Lavenergihuse Og Passivhuse". Accessed January 10, 2022. https://www.bolius.dk/lavenergihuse-og-passivhuse-18470

Skovgaard, Maja et.al. *Indeklima og sundhed i boliger : resultater og gode råd til et sundere indeklima fra forskningssamarbejdet CISBO til byg- og driftsherrer, rådgivere i byggeriet, sundhedspersonale og beboere*. Edited by Maja Skovgaard et.al. Aarhus, Kbh.: CISBO, 2016.

Videncenter for Energibesparelser i Bygninger. "Guide Til Ventilation i Enfamiliehuse", December 2017. https://docplayer.dk/68672833-Guide-til-ventilation-i-enfamiliehuse-guide-nyhedsbrev.html.

# WHAT WE KNOW ABOUT THE IMPACT OF ARCHITECTURE IN MENTAL HEALTH

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## INTRODUCTION

One of the specific themes of architecture is nature and more specifically the approach of its relation to nature. There are several authors who refer to this relationship with nature as a great advantage to mental and physical health.

## SYNTHESIZED RESEARCH

However, many of these statements do not result from scientific investigations, but from certain observations, which are extrapolated, without having been effectively tested, and, as the authors state, should be subjected to deeper and more systematic investigations. This type of studies, which, despite being carried out by accredited authors, try to synthesize the research and information available on the topics addressed. (In this case are the authors Marcelo Amaral, Cagil Kayan, Mayra Arellano, Maha Ibrahim, Andrew J. Hoisington et al, Annemarie Mantler and Alan C. Logan, Andréa de Paiva and Richard Jedon, Smeh Azzazy et al, Emily Anthes, Bettieli Silveira and Maria Felippe, Rodolfo Coelho, Howard Frumkin, Bernard Dan, and Mohammad Maleki and Qader Bayzidi, whose claims will be summarized below.)

The author Marcelo Amaral argues that several cultures use the theme of nature in architecture to convey calm, tranquility, and reflection, being one of them the eastern culture. This culture combines the presence of nature with a pleasant environment in order to incite feelings of tranquility and calm.[1]

Cagil Kayar says that nature promotes an enriching neurological stimulation, and that the ecological complexity stimulates the human brain and that serves both as a distraction and a source of relaxation.[2]

Mayra Arellano says that the natural environment is related to personal well-being, longevity, the reduction of cardiovascular diseases, the enhancement of recovery, the reduction of symptoms of anxiety and depression, and the decrease of fear and anger. All this creates a positive emotional balance in the human being.

In addition to green environments, the author highlights as equally important to the human beings the bodies of water. The water can convey calm and tranquility.

As an example, the author mentions the Salk Institute by Louis Kahn funded in 1963, where the water enters the patio and may trigger a feeling of mental clarity and direct connection to the ocean, being able to transport us directly to the natural environment.[3]

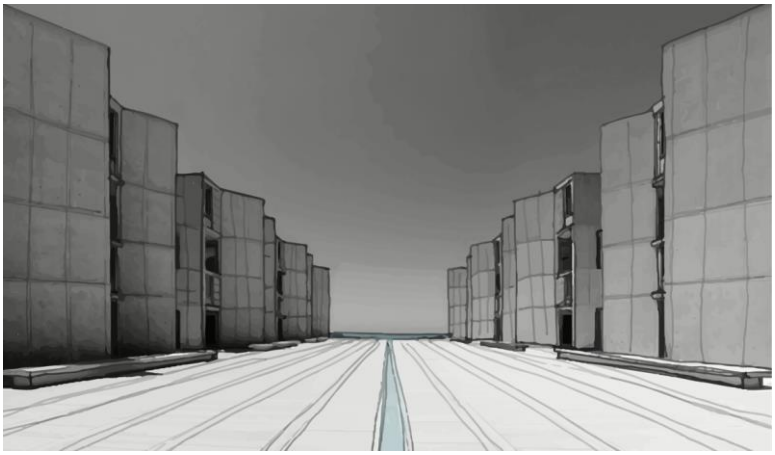

*Figure 1. Salk Institute, San Diego.*

Regarding the use of therapeutic gardens, the same author argues that they can help to strengthen the memory and with the perception of time when people take care of them. They also contribute to a lesser sense of closure.

Refers also as important the introduction of natural environments in urban areas because these types of environments can be an effective way to mitigate the consequences of the increased cognitive load that is usually characteristic of modern urban environments.[4]

Maha Ibrahim says that supporting working memory, improved concentration, faster recovery from surgery and stimulating learning abilities is achieved through observing Nature. In addition, it still could enhance recovery in its broadest sense.

He also mentions that bodies of water, their sound effect, is associated with a meditative and relaxing state of the body and mind.[5]

The author Andrew J. Hoisington et al speculate that urban areas have a higher rate of mental disorders compared to greener rural spaces.[6]

Annemarie Mantler and Alan C. Logan state that the introduction of nature into the urban environment positively influences cognitive restoration after a state of mental fatigue, creating more vitality and satisfaction with life in general.

They argue that residents who live in areas where green spaces round eighty percent, have a better sleep pattern, practice more physical exercise and have less emotional distress.

They also highlight a Dutch study where it is evident that urban environments that have a deficit of green areas are associated with a higher risk of developing depression and anxiety disorders by the residents. This is compared to residents who are in, or are close to, urban areas with a higher percentage of green spaces.

Moreover, the authors mention that bodies of water, in addition to green spaces, have a positive impact on physical and mental health and personal well-being.

The same authors also claim that there is an increase in the productivity of workers who look at a natural landscape, or even plants in their workspace.[7]

The authors Andréa de Paiva and Richard Jedon say that green spaces and bodies of water improve the response of the immune system. This type of space can represent a great advantage for large, populated cities, since its short-term exposure, even if for a few minutes, already reduces blood pressure, stress levels and enhance muscle relaxation. If it is a long-term exposure, it can improve the immune system.[8]

Smeh Azzazy et al, in addition to all stated, alleges that when human beings move from a rural area to a very bustling urban area, such as a shopping center, it increases the state of conflict, frustration and participation of the individual, consequently reducing the levels of relaxation and meditative state.
The author also notes that observing urban landscapes, compared to observing natural environments, rapidly increases the number of times a person blinks their eyes as well their cognitive effort[9].
Emily Anthes says that students who look at natural elements from their window are more focused than those who only view human-made buildings.[10]
Bettieli Silveira and Maria Felippe mention that the observation of nature, through windows, has the great advantage of enhancing the sense of freedom, movement, and social interaction.
They also say that in a hospital environment, the presence of views of nature, applied in a controlled and appropriate way, has the following positive effects: pain reduction, decrease of hospital stay, less wear and tear and less stress for health professionals, greater patient satisfaction, and reduction of depressive states.[11]
Continuing with the hospital theme, Rodolfo Coelho emphasizes that when talking about a patient's room if it has a natural view, it will transmit to the occupants the feeling of having been transported to a natural environment, to a pleasant space, not reenforcing the fact that they are in a hospital receiving a certain treatment.[12]
Howard Frumkin argues that seeing or being in a savannah conveys feelings of tranquility, peace, relaxation, a decrease in fear and anger. On the other hand, defends that the sight of this type of landscape causes an increase in the state of vigilance and mental alertness.[13] This final argument supports the claim that if we are not safe in these types of scenarios, or if we do not feel safe, our body will activate the “fight or flight” instinct. Consequently, our alertness to outside threats increases due to the state of anxiety necessary to flee.
Bernard Dan states that, in the mid-1980s, Roger Ulrich noticed that people hospitalized with a room overlooking a natural landscape, had less pain, called nurses less, and went home earlier, compared to people with the same conditions, but with the view of a brick wall.
This author also mentions that therapeutic gardens are a good strategy due to easy implementation. That is one of the reasons why these types of gardens are very common today, among other places, in pediatric hospitals, oncology wards, mental and behavioral health care, nursing homes and dementia centers.[14]
Nevertheless, these apologetic aspects of the presence of nature in architecture needs to be scrutinized, as certain relationships with nature may have harmful effects. Mohammad Maleki and Qader Bayzidi argue that if a landscape is too aggressive, like a window over a cliff, it will make the individual stressed and uncomfortable. Circumstances of this type may lead the individual leave the space where he is – which in the case of hospitals, clinics and housing would be quite problematic. They give an example of the feeling one has when crossing the Glacier Skywalk, where the visitor is about two hundred and eighty meters from the ground. According to these authors, the visitor receives the same adrenaline that is experienced on a roller coaster. This happens more specifically when people transition from the steel part to the glass part, having the sensation that they are suspended in the air. These types of experiences create a very intense sense of fear and are extremely destabilizing.[15]

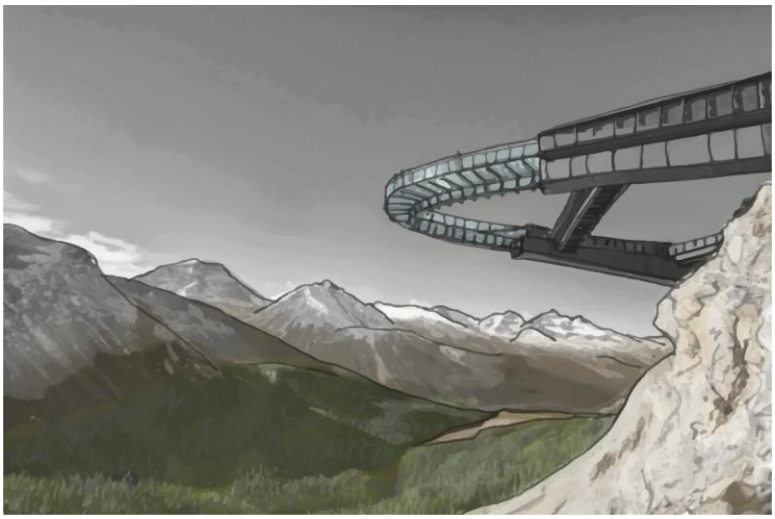

*Figure 2. Glacier Skywalk, Canada.*

## AUTHORITIES' AUTHORS

In another perspective are the authors who can be considered authorities on the subject and who express their opinion based on their experiences and references. In this parameter are the authors Henrique Muga, professor of the Psychology of Art, at the time of conclusion of the book, master's in psychology and Doctor in Social Sciences; Paul Sivadon, pioneer psychiatrist in Psychopathology of work in France and university professor in Brussels; and finally, Christine Nickl-Weller and Hans Nickl, both Architects and professors at the Technological University of Berlin.

Henrique Muga bases his studies mainly in Portuguese cities such as Porto and Lisbon. However, he uses examples from other countries such as Morocco, São Tomé and Príncipe and Cape Verde.

Based on this, Henrique Muga says that there is evidence that spaces with the presence of vegetation are considered less dense (decreasing the feeling of being in an enclosed space and perceived as less crowded).[16]

Paul Sivadon bases his experience on the vast years working in Psychology and in the different hospitals where he worked in France, being able to later apply his concepts and reflections on the interrelationships of humans with the environment and space in his clinic and in the psychiatric hospital in La Verrière.

Thus, the Psychologist Paul Sivadon dialogues about one of the safety conditions that human beings need and the possibility of getting out of the constraints of the built environment and finding the natural environment to which our nervous system is used to. According to the author, this explains the mass exodus of the city's inhabitants to places where there is sun, sea, and the most varied sources of nature. With the routines of everyday life and over the years, people more and more seek for a return to a house surrounded by a garden to represent the equivalent of a weekly getaway. Although in smaller quantities human beings, like animals, need direct contact with living nature and natural elements. To compensate for this lack of nature, city dwellers tend to surround themselves with plants and domestic animals.

With this, Sivadon does not mean that we should make a city in the countryside. Sivadon wants to transmit the notion that the function of architecture is to promote balance, both in relations between human beings and in relations with nature.

To Sivadon, among many other definitions, balance can be considered as an alternation between the built environment and nature, having the possibility of escaping the built environment made by

humans to find nature. This periodic return to our “animal origins” allows us to find a balance between the civilized and the natural world.[17]
In the case of authors Christine Nickl-Weller and Hans Nickl, their experience is based on references around the world and on the analysis of hospital architectural morphology in countries such as Germany, Austria, Singapore, Russia, Denmark, United States, Canada, and China.
Therefore, the authors Christine Nickl-Weller and Hans Nickl mention the KTP hospital in Singapore as another positive example of the implementation of water in architecture. There is a discreet connectivity and a sense of belonging to the natural world thru the implementation of a waterfall in the hospital garden.[18]

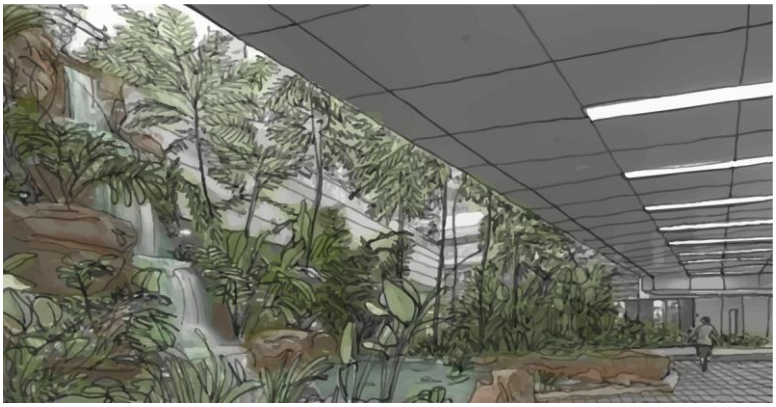

*Figure 3. KTP Hospital, Singapore.*

Thus, these statements must be analyzed in the context of the cities analyzed, that is, what is in relation is a certain urban landscape – quite disordered and dehumanized – in contrast to the domesticated nature of rural spaces, or, in extreme cases, relations with rougher landscapes, but at a distance and through architectural devices that filter their impact.
As when Sivadon refers escapes to certain rural locations he is probably referring to French landscapes, not having in mind harsh landscapes such as jungles, mountainous places, or impenetrable forests.

## SCIENTIFIC BASIS

Finally, there are authors who represent the scientific basis for their intuitions and statements. These authors are Margarita Triguero-Mas et al, Pals et al and Marianne Gonzalez et al. Nevertheless, it is necessary to consider the sphere in which they were made.
The author Margarita Triguero-Mas et al supports the thesis that over the years natural environments have been associated with good physical and mental health. Also argues that there is evidence that small niches of green spaces should be introduced in urban spaces such as small gardens, trees, and natural paths.[19]
Pals et al argues that it is possible that introducing non-harmonious elements during natural elements can reduce its restorative effect due to lack of coherence, as explained in his study about the use of metallic or wooden furniture in a virgin natural environment. However, the author admits that the introduction of natural spaces positively influences restoration.[20]
Marianne Gonzalez et al refers in a study addressed by the author, that it was noticed that people who were taken from their homes to a farm, over a period, had high restoration values in their levels of attention. The same thing continued to happen when they returned to their residences and implemented the concept of therapeutic gardens.

The author argues that psychological distance from everyday obligations and problems, with sufficiently high levels of distraction and effortless attentional involvement, can be achieved through these therapeutic gardens, creating a decrease in depression and anxiety and even increase the ability to concentrate. Due to the feeling of fascination, and because they change a person's focus, of their problems or disorders, these gardens help in achieving good mental health and potentiate the treatment of anxiety and depression.

According to Gonzalez, this type of therapeutic gardens are a good strategy, and easy to implement by nurses, to help patients in their recovery, of, for example, depression.[21]

In the case of the author Margarita Triguero-Mas et al, data from interviews conducted in Catalonia, Spain, between 2010 and 2012 present in the Catalonia Health Survey were analyzed. In this study, 18,525 adults were approached but only 9,408 completed the surveys.

Data collected included sociodemographic characteristics, overall self-perception of health, mental health, physical activity, and social support.

The study was based on the presence, or access, to natural environments within a three-hundred-meter radius of the respondent's residence. These green areas included places such as urban green areas, agricultural land, pasture areas and non-urban areas with vegetation such as forests or forest parks.

Thus, it can be said that the conclusions obtained through this study can only be stated and valid for places that present similar characteristics to the analyzed area, Catalonia, and that are surrounded by the same characteristics of natural environments mentioned and present in this autonomous Spanish community.

The second study, carried out by Pals et al in 2014, refers to the analysis of three environmental conditions. A natural environment with metallic furniture, one with wooden furniture and the other without any kind of furniture.

This natural environment was based on a project, yet to build at the time of the study, in Netherlands. A total of one hundred and thirty-one students, forty-eight men and eighty-three women participated in this study and the entire analysis was based on an environment created in virtual reality.

This park created in virtual reality contained grass, plants, bushes, trees, water, and a path that surrounded the entire area. To make the experience more realistic and dynamic, the researchers added some moving virtual animals, such as butterflies, and audible bird sounds.

Thus, this study can only be accepted as true in this controlled environment of virtual reality. The conclusions reached by the author will only be valid in this type of park, in Netherlands, and in the conditions created by the specialists in virtual reality. As real as virtual reality may seem, it will never reach the true experience of experiencing a real space and the impact it can have on us. It should be noted that spatial or environmental perception results from twenty-one different types of stimuli, so tests that consider only the visual stimulus cannot be expected to be effective.

Finally, Marianne Gonzalez et al conducted a study involving twenty-eight people diagnosed with clinical depression in Norway.

The program consists of evaluating changes in terms of stress and social interaction in adults with clinical depression when interacting with therapeutic gardens. The program had assessments of the participants' psychological states before, during and after their participation in the program.

These therapeutic gardens were in various urban agricultural areas in Norway. This program lasted twelve weeks with a three-month follow-up. Participants also continued the treatments prior to the study.

Here, too, the conclusions obtained must be limited to the parameters of the experience, that is, in urban and agricultural areas of, or similar to, Norway.

## CONCLUSION

In conclusion, we can say that the relationship between Architecture and Nature is advantageous in certain situations. Nature can be advantageous for human mental health if used in very specific situations such as the introduction of small green spaces, with architectural quality, in a modern and high-density urban space, as mentioned by Triguero-Mas et al, or in the use of water as mentioned by Arellano, at the Salk Institute or at the KTP Hospital mentioned by Nickl-Weller and Nickl. Or in places, as mentioned in the Dutch study, where the lack of greenery near the residences leads to a greater risk of developing depression and anxiety, among many other statements described throughout this part.

However, and as mentioned by some of the authors such as Maleki and Bayzidi, the presence of uncontrolled or wilding landscapes may have a harmful effect on people. A natural landscape such as a jungle, a dense and impenetrable forest, a cliff over a river or a completely unprotected savannah can cause a feeling of intense fear and be highly harmful to the human being. Another aspect that can be harmful will be the introduction of green spaces, in places that are already balanced by themselves despite not having many green environments.

The relationship with the outside and with nature will be preferable if the outside has the characteristics of control and pleasantness and if the inside has a balanced relationship with it.

Apart from relationships of that type, the statements previously mentioned, cannot be accepted as certain. More studies would have to be done to support the other variables.

## NOTES

[1] Marcelo Guerra do Amaral, “Centro Terapêutico Para Pessoas Com Depressão” (2018).
[2] Cagil Kayan, “Neuro-Architecture: Enriching Healthcare Enviroments for Children” (2011).
[3] Mayra Ruiz Arellano, “Hawaiian Healing Center: A Weaving of Neuro-Architecture and Cultural Practices” (2015).
[4] Arellano.
[5] Maha Mahmoud Ibrahim, “The Integration of Interior Design and Neuroscience: Towards a Methodology to Apply Neuroscience in Interior Spaces,” Architecture and Arts 4, no. 14 (2019): 36–57.
[6] Andrew Hoisington et al., “Ten Questions Concerning the Built Environment and Mental Health,” Building and Environment 155, no. January (2019): 58–69.
[7] Annemarie Mantler and Alan Logan, “Natural Environments and Mental Health,” Advances in Integrative Medicine 2, no. 1 (2015): 5–12.
[8] Andréa de Paiva and Richard Jedon, “Short- and Long-Term Effects of Architecture on the Brain: Toward Theoretical Formalization,” Frontiers of Architectural Research 8, no. 4 (2019): 564–71, https://doi.org/10.1016/j.foar.2019.07.004.
[9] Sameh Azzazy et al., “A Critical Review on the Impact of Built Environment on Users’ Measured Brain Activity,” Architectural Science Review 0, no. 0 (2020): 1–17.
[10] Emily Anthes, “Building Around the Mind,” Scientific American Mind, 2009, 33–39.
[11] Bettieli Barboza da Silveira and Maíra Longhinotti Felippe, *Ambientes Restauradores: Conceitos e Pesquisas Em Contextos de Saúde*, 2019.
[12] Rodolfo Coelho, “Vivências Fragmentadas” (Faculdade de Arquitetura de Lisboa, 2019).
[13] Howard Frumkin, “Beyond Toxicity: Human Health and the Natural Environment,” American Journal of Preventive Medicine 20, no. 3 (2001): 234–40.
[14] Bernard Dan, “Rehabilitative and Therapeutic Neuroarchitecture,” Developmental Medicine and Child Neurology 58, no. 11 (2016): 1098.
[15] Mohammad Reza Maleki and Qader Bayzidi, “Application of Neuroscience on Architecture: The Emergence of New Trend of Neuroarchitecture,” Kurdistan Journal of Applied Research 2, no. 3 (2017): 383–96.
[16] Henrique Muga, *Psicologia Da Arquitetura*, ed. Gaialivro, 2006.
[17] Paul Sivadon and Colectânea de textos elaborada por Marc Crunelle, “Influences et Interactions Homme - Milieu Construit,” n.d., 1–94.
[18] Christine Nickl-Weller and Hans Nickl, *Healing Architecture*, ed. Gisela Pitsch, 1ª edição (Braun Publishing AG, 2013).
[19] Margarita Triguero-Mas et al., “Natural Outdoor Environments and Mental and Physical Health: Relationships and Mechanisms,” Environment International 77 (2015): 35–41.
[20] Roos Pals et al., “Physical Features, Coherence and Positive Outcomes of Person-Environment Interactions: A Virtual Reality Study,” Journal of Environmental Psychology 40 (2014): 108–16.
[21] Marianne Thorsen Gonzalez et al., “Therapeutic Horticulture in Clinical Depression: A Prospective Study of Active Components,” Journal of Advanced Nursing 66, no. 9 (2010): 2002–13.

## BIBLIOGRAPHY

Amaral, Marcelo Guerra do. “Centro Terapêutico Para Pessoas Com Depressão,” 2018.
Anthes, Emily. “Building Around the Mind.” Scientific American Mind, 2009.
Arellano, Mayra Ruiz. “Hawaiian Healing Center: A Weaving of Neuro-Architecture and Cultural Practices,” 2015.
Azzazy, Sameh, Amirhosein Ghaffarianhoseini, Ali GhaffarianHoseini, Nicola Naismith, and Zohreh Doborjeh. “A Critical Review on the Impact of Built Environment on Users’ Measured Brain Activity.” Architectural Science Review 0, no. 0 (2020): 1–17. https://doi.org/10.1080/00038628.2020.1749980.
Coelho, Rodolfo. “Vivências Fragmentadas.” Faculdade de Arquitetura de Lisboa, 2019.
Dan, Bernard. “Rehabilitative and Therapeutic Neuroarchitecture.” Developmental Medicine and Child Neurology 58, no. 11 (2016): 1098. https://doi.org/10.1111/dmcn.13246.
Frumkin, Howard. “Beyond Toxicity: Human Health and the Natural Environment.” American Journal of Preventive Medicine 20, no. 3 (2001): 234–40. https://doi.org/10.1016/S0749-3797(00)00317-2.

Gonzalez, Marianne Thorsen, Terry Hartig, Grete Grindal Patil, Egil Wilhelm Martinsen, and Marit Kirkevold. “Therapeutic Horticulture in Clinical Depression: A Prospective Study of Active Components.” Journal of Advanced Nursing 66, no. 9 (2010): 2002–13. https://doi.org/10.1111/j.1365-2648.2010.05383.x.

Hoisington, Andrew, Kelly Stearns-Yoder, Steven Schuldt, Cody Beemer, Juan Maestre, Kerry Kinney, Teodor Postolache, Christopher Lowry, and Lisa Brenner. “Ten Questions Concerning the Built Environment and Mental Health.” *Building and Environment* 155, no. January (2019): 58–69. https://doi.org/10.1016/j.buildenv.2019.03.036.

Ibrahim, Maha Mahmoud. “The Integration of Interior Design and Neuroscience: Towards a Methodology to Apply Neuroscience in Interior Spaces.” Architecture and Arts 4, no. 14 (2019): 36–57. https://doi.org/10.12816/mjaf.2019.25813.

Kayan, Cagil. “Neuro-Architecture: Enriching Healthcare Enviroments for Children,” 2011.

Maleki, Mohammad Reza, and Qader Bayzidi. “Application of Neuroscience on Architecture: The Emergence of New Trend of Neuroarchitecture.” Kurdistan Journal of Applied Research 2, no. 3 (2017): 383–96. https://doi.org/10.24017/science.2017.3.62.

Mantler, Annemarie, and Alan Logan. “Natural Environments and Mental Health.” Advances in Integrative Medicine 2, no. 1 (2015): 5–12. https://doi.org/10.1016/j.aimed.2015.03.002.

Muga, Henrique. *Psicologia Da Arquitetura*. Edited by Gaialivro, 2006.

Nickl-Weller, Christine, and Hans Nickl. *Healing Architecture*. Edited by Gisela Pitsch. 1ª edição. Braun Publishing AG, 2013.

Paiva, Andréa de, and Richard Jedon. “Short- and Long-Term Effects of Architecture on the Brain: Toward Theoretical Formalization.” Frontiers of Architectural Research 8, no. 4 (2019): 564–71. https://doi.org/10.1016/j.foar.2019.07.004.

Pals, Roos, Linda Steg, Jos Dontje, Frans Siero, and Karin van der Zee. “Physical Features, Coherence and Positive Outcomes of Person-Environment Interactions: A Virtual Reality Study.” Journal of Environmental Psychology 40 (2014): 108–16. https://doi.org/10.1016/j.jenvp.2014.05.004.

Silveira, Bettieli Barboza da, and Maíra Longhinotti Felippe. *Ambientes Restauradores: Conceitos e Pesquisas Em Contextos de Saúde*, 2019.

Sivadon, Paul, and Colectânea de textos elaborada por Marc Crunelle. “Influences et Interactions Homme - Milieu Construit,” n.d., 1–94.

Triguero-Mas, Margarita, Payam Dadvand, Marta Cirach, David Martínez, Antonia Medina, Anna Mompart, Xavier Basagaña, Regina Gražulevičiene, and Mark J. Nieuwenhuijsen. “Natural Outdoor Environments and Mental and Physical Health: Relationships and Mechanisms.” Environment International 77 (2015): 35–41. https://doi.org/10.1016/j.envint.2015.01.012.

# APPLYING THE RESILIENCE PERSPECTIVE TO DESIGN THE FUTURE PLANNING STRATEGIES AS AN IMPACT OF COVID-19: CASE OF THE HONG KONG ELDERLY CARE HOMES

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## INTRODUCTION

Population aging and urbanization are two global trends that together comprise major forces shaping the 21st century[1]. At the same time as cities are growing, their share of residents aged 65 years and older is also increasing. According to World Population Prospects 2019[2], by 2050, 1 in 6 people in the world will be over the age of 65, up from what was 1 in 11 in 2019.

Hong Kong (HK), one of the most densely populated cities in the world, is no exception. According to the "Hong Kong Population Projections 2017-2066", the number of elderly people aged 65 and over will increase from 16.6% of the population (1.16 million) in 2016 to 36.6% of the population (2.59 million) in 2066. The consistent rise in the proportions and, subsequently, the high demand for residential care homes for the elderly (RCHE) sets the scope for a lot of research to be done related to the enhancement of living standards through better design strategies and the use of innovative gerontechnology.

This paper tries to study the present situation the RCHEs are facing to deal with the demand and its functioning amidst the ongoing pandemic of COVID-19 in the context of Hong Kong. The findings of the study will be useful in developing design guidelines for improved living conditions in socio-spatial arrangements inside high-density cities, considering the impact of pandemics on the living spaces of the elderly.

## THE LOCAL CONTEXT AND THE GLOBAL HEALTH CRISIS

The global population is aging rapidly. Population ageing is happening more quickly than in the past. For example, while France had almost 150 years to adapt to a change from 10% to 20% in the proportion of the population that was older than 60 years, places like Brazil, China and India will have slightly more than 20 years to make the same adaptation[2]. With the changing demographic profile, there is a global imperative to focus on policy updates and attitude shifts toward the segment of the population that currently has and will continue to hold increasing relevance in the coming years. Amongst other major outlines set by global organizations like WHO, preparing for the economic and social shifts associated with an ageing population is thus essential to fulfil the pledge of the 2030 Agenda for Sustainable Development that “no one will be left behind”[4].

Concurrently, the recent global health crisis in the form of the pandemic has served as a wake-up call for many, while also bringing to light a long-overdue concern that has been raised by many scholars and practitioners over a long period of time. After being presented with what is arguably the most significant public-health catastrophe of our time, COVID-19, the global healthcare system proved to be underprepared and failed dismally at several layers. Adding to the urgency, the pandemic hit the populations in an unbalanced manner, that affected the elderlies and children more severely than the youth mostly due to compromised immune systems. This made the sections with the elderlies more vulnerable and were more susceptible to the pandemic and at risk more than the rest of the population[5,18,19].

A report on ageing by the United Nations (UN) indicated that the rate of increase in the proportion of China's ageing population (60 years and over) will become the highest in the world, with a projected increase from 12.4% in 2010 to 28.1% in 2040[6]. Under the effects of increased life expectancy, hence, the rapid growth of its older population, Hong Kong faces a comparable serious ageing challenge. Hong Kong has experienced a continuous decline in the mortality rate during 1996 to 2016 (refer HK Census Department statistics), leading to an increase in life expectancy which effectively adds to the increased proportions of the silver population. According to the latest population census from the year 2011[7], elderly people accounted for 13.3% of Hong Kong's population whereas it was only 2.8% in 1961. Data collected from the by-census in 2016 from the Census and Statistics Department (HKSAR) also highlighted the rise of the residents to being increased by 67 per cent who are aged 80 or above. It is hence clear that the proportion of elderly people in Hong Kong will continue to increase over the next 50 years[8]. The data clearly sets out a wide array of possible fields of research related to the rising numbers of the elderlies and its effects.

Certainly, much research and policy reevaluations are needed to address the rising numbers in Hong Kong to accommodate and enhance the quality of life (QOL) focusing on this section of the society particularly.

## HONG KONG'S UNIQUE ARCHITECTURE AND HOUSING CRISIS

The former fishing port of Hong Kong, which was ceded to Britain in 1842 and became a British colony, has grown into an international city with enormous industrial, commercial, and financial accomplishments by the twenty-first century. In spite of the fact that the city has a hilly topography and that its population is rising speedily, the urban sprawl has been spectacular, resulting in a constant scramble for the limited amount of land available for residential and economic development purposes resulting in a significant increase in skyscrapers. After 60 years of post-World War II development, the city's fabric has begun to show signs of wear, and a substantial number of old private tenement buildings have fallen into a state of severe decay that needs attention and revitalization[9]. Approximately 40% of the buildings in the urban area are constructed 30 years or before[10]. Because building space is limited, it's no wonder that a city with such a high visual density has more skyscrapers than any other city on the planet. According to the Council on Tall Buildings and Urban Habitat, Hong Kong has 355 structures that are more than 150 meters tall (CTBUH). With an extreme space crunch, the available average square footage of living space per person is one of lowest compared to other comparable mega cities like New York, Singapore etc.

In 2016, the median floor area of domestic households was approximately 430 square feet (sq ft), while the median per capita floor area of accommodation was approximately 161 sq ft, with over 90% of households in the territory were inhabiting spaces of less than 753 sq ft. Additionally, 8.1 percent of the approximately 2.508 million accommodations in Hong Kong had a floor area of less than 215 square feet, while 4.9 percent were private permanent housing. Such data indicate that the housing area of Hong Kong residents is shrinking, which contradicts the Government's stated goal of

increasing the per capita floor space of housing. The housing situation is still critical and faces heat from the general public.

*Figure 1. The Peninsula Hotel, in Hong Kong, in the 1920s. Photo: SCMP*

Because of rising housing prices, Hong Kong has been called one of the world's most unaffordable city for a record thirteen consecutive years. And if the city can contain the fifth wave of the Covid-19 outbreak, the trend is likely to continue. The index for lived-in homes fell about 0.3% in December to 392.5 from November but rose 3.3% year on year. After reaching a record high in September, the index fell 1.4 percent in the fourth quarter[17]. It is a common observation that the rising property prices have made it increasingly normal for families spanning several generations to live together in cramped quarters in small apartments, and that young people are continuing to live with their parents even after they have married. Furthermore, as the population of Hong Kong continues to shrink, the living standards of the people of Hong Kong are deteriorating as a result. This existing crisis becomes a worrying factor in the times of COVID-19 where close proximity to people is usually advised to be avoided against the fact that the general people live in an accommodation that is congested and not well ventilated mostly.

*Figure 02: Present bird's eye view of Hong Kong, 2022. Photo: Philipp Engelhorn*

## HONG KONG AND ITS STANCE WITH COVID-19

Hong Kong escaped the first wave of the COVID-19 outbreak relatively unscathed and had a flatter epidemic curve than most other places, which experts find remarkable given its status as an international transportation hub. Furthermore, its proximity to the mainland China, as well as the millions of mainland visitors it receives each year, would make it vulnerable as well. Despite this, it had done a good job of containing the virus's spread, thanks in large part to SARS's previous experience. Some experts now believe that the practice of wearing masks in public since the 2003 SARS outbreak may have contributed to the limited 845 confirmed infections and four deaths by the beginning of April 2020 when the entire globe was registering cases in large numbers per day[11].

Recently, after almost two years of sustaining the tight restrictions to abide by the zero-COVID Policy by the government, there is divided thought aligning with the public opinion. Hong Kong has failed to vaccinate its elderlies, who are the most vulnerable to the virus and its variants. The scientific community of researchers is skeptical about this small percentage of vaccinated elders, which could be the next reason of a significant number of negatively affected people in Hong Kong.

Dr. Thomas Tsang Ho-fai, former head of the Centre for Health Protection in Hong Kong, emphasizes the stark difference between the inoculation rate for Hong Kong's elderly which is one of the lowest of any local demographic and that of numerous developed countries, where 80 to 90% of them have been vaccinated[12]. The controlled numbers of the cases locally have given a sense of relief or a fake assurance to not get inoculated majorly by this section of the society, that can potentially bring them into extreme pressure if there is any crack in the system.

## HONG KONG AND ITS ELDERLIES

According to the facts and figures discussed previously, it is evident that the elderly constitutes a significant segment of Hong Kong society. A large proportion from this section tend to opt for staying in the care homes for various reasons. It is imperative to say that the rising numbers of the elderlies in Hong Kong showcases that there is a high demand for places in elderly-care homes as well. The usual waiting period to avail for elderly-care homes is around 36 months[13]. As listed by the Social Welfare Department, a residential care service in Hong Kong comprises of-

1. Hostels for the elderly;
2. Homes for the aged.
3. Care & Attention (C&A) Homes for the elderly; and
4. Nursing Homes.

It is well established that the physical environment has a significant impact on one's level of satisfaction and health-related quality of life (HRQOL). Long-term care systems allow older persons with considerable capacity declines to receive the care and assistance they need to live a life that values their basic rights, fundamental freedoms, and human dignity. The establishment of long-term care systems can also aid in reducing inappropriate use of acute health-care services, assisting families in avoiding catastrophic care costs, reduced social-distancing norms, and allowing women who are typically the primary caregivers, to take on larger societal roles[14]. There are about 595 homes providing Residential Care Services for the Elderly in Hong Kong currently[15]. The range of services provided within the care home varies from its sub-types but runs on similar principles of person-centric care. The research aims at understanding the effects of the designed spaces on the elderlies and to what extent these were helpful in combatting the past two years of the pandemic.

## HK ELDERLY CARE HOME STANDARDS AND PRACTICES

To ideate the process of learning about the current struggles that the RCHE's are facing in the times of a pandemic in the past two years in high dense city like Hong Kong, firstly, a deep review of the existing literature was carried out to understand the working systems of the care homes over the years. The acute shortage of spaces in the city has given a separate set of working guidelines and space requirements that is unique and is quite apt for the smooth functioning of the care homes locally. After a thorough understanding of the existing norms and practices through the available literature, series of semi-structured interviews were taken with the care home staff and the residents themselves along with the questionnaires to analyze what were the key features that supports the RCHEs and what were the disrupting elements in the past two years that got added in the physical realm of their lives. A series of key highlights are derived from the interviews conducted from the users of the care homes that can form the base for the guidelines that are necessary for designing well thought, inclusive and evidence-informed care homes of the future that are prepared to accommodate health crisis like COVID-19.

## RESILIENCE SCHEME UNDER COVID

A paradigm shift is required to enable the aging population to become society's new driving force. With the rising numbers of the baby-boomers and expected increased frequency in the number of such zoonotic outbreaks globally calls for paying heed to the long-standing question of attending to the elderly-care needs. The current pandemic can be used to explore these issues in depth and develop strategies that can uplift the existing living standards of such service seekers. Especially in the high dense cities like Hong Kong where the shortage of liveable spaces makes the facilitation of services a challenging affair. The research was conducted in the form analyzing the available literature related to the working of the care homes for the elderlies.

The available data highlights the agenda of the Government that is gradually trying to focus on paying more attention to the elderly-care needs and bringing in more elderly friendly guidelines to incorporate in the working systems. Several schemes are designed for easing the struggles of the silver generation like the Social Security Allowance Scheme gives a monthly stipend to citizens of Hong Kong who are 65 years of age or older, or who are severely disabled. Elders who are financially in need can also apply for Comprehensive Social Security Assistance (CSSA) to help them satisfy their basic necessities. Subsidies are granted to a variety of social service organizations, district organizations, and educational institutions, among others, to carry out a variety of programs that enable elderly people to develop their potentials, contribute more to society, and foster a sense of self-worthiness. These attempts strive to encourage the development of a compassionate and inclusive society by motivating these groups to become more involved in community activities[16].

## PERSPECTIVES AND RECOMMENDATIONS

To address the challenges of an aging society, the government and other sectors should monitor midlife and older adult employment trends to inform policy development, such as improving the employment prospects of older workers, establishing age-friendly working environments, etc. With an emphasis on the design characteristics of aged care facilities, multiple interviews were conducted with users, which included both residents and staff from the RCHE's preferably with an experience of staying in the care homes for at least 2 or more years, so that they are well aware of the environment and can share their experiences and discomforts throughout the pandemic period.

During the pandemic, the elderly care homes were critically hit almost everywhere in the globe like the USA, Canada, or Brazil[20]. Fortunately, due to the restricted number of cases in Hong Kong, the care homes didn't face extreme pressure but instead it became the only space that the elderlies spent

their 24 hours without any connect with the outside world for months. The only contact with their families and outside world was through the telecommunication and video chats arranged bi-weekly by the staff usually and a few glances from the window. The outcomes of the intense discussion and questionnaire were more positively inclined towards the care homes that had flexible spaces which accommodated several activities in different hours of the day. These open spaces were then used for arranging art classes, group exercise activities, or spaces to simply communicate still maintaining the social distancing guidelines. Care homes that lacked these spaces frequently had negative associations with their experience. The care homes that had more single rooms than shared rooms were positively regarded by the users as they probably felt safer in their own limited spaces[21]. Although the concept of flexibility is highly complex and include a variety of features such as transformability or scalability, the idea of designing a resilient facility able to adapt to the unexpected epidemiological, technological, social changes is always desirable, especially in the light of the recent COVID-19 pandemic[22,23]. It is recommended to adopt more flexible spaces during the planning stage that can accommodate multiple activities during different hours and requirements. The option of altering the usage/function of the spaces in the analyzed scenarios demonstrates the adaptability of flexible solutions to changing situations. Learning from the cases, it can also be stressed to incorporate more openings that gives a direct connection with the outer world.

## CONCLUSION

The ability to adapt to changing conditions and maintain or regain functionality and vitality in the face of stress or disturbance is referred to as resilience. It is the ability to recover after a setback or interruption. A crisis can be a catalyst for enhancing the overall resilience of affected population equally as it can expose and amplify its vulnerability[24]. The crux of the matter is that attitudes toward designing spaces for the elderly require much more care and attention to factors such as flexibility and resilience to create spaces that can be a safe haven for users who are already vulnerable and require an environment that is reciprocative of these concerns. The study revealed some of the deep issues that the elderlies have faced in recent years, including firsthand experience with the crisis, and trying to deal with physio-psycho pressure within the built environments. These minor yet critical additions such as flexible spaces and separate zones for private and community spaces could result in a more positive outlook and a better environment for the elderly in care homes.

## NOTES

[1] Aurora García Ballesteros, Beatriz Cristina Jiménez Blasco, “Aging and urbanization: implications of two coincident processes” Geographical Investigations, (89), 58-73, (2016), https://doi.org/10.14350/rig.47362

[2] United Nations, Department of Economic and Social Affairs, Population Division. *World Population Ageing 2019: Highlights* (ST/ESA/SER.A/430), (2019), accessed March 22, 2022, https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2019-Highlights.pdf

[3] United Nations, Department of Economic and Social Affairs, Population Division. *World Population Ageing 2017 - Highlights* (ST/ESA/SER.A/397), (2017), accessed March 17, 2022, https://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2017_Highlights.pdf

[4] “Transforming our world: the 2030 Agenda for Sustainable Development,” United Nations, Department of Economic and Social Affairs, accessed February 24, 2022, https://sdgs.un.org/2030agenda

[5] Mohammed Zahir Ahmed, Oli Ahmed, Zhou Aibao, Sang Hanbin, Liu Siyu, Akbaruddin Ahmad, “Epidemic of COVID-19 in China and associated psychological problems,” Asian J. Psychiatry. 51:102092, ISSN 1876-2018, (2020), https://doi.org/10.1016/j.ajp.2020.102092

[6] United Nations, Department of Economic and Social Affairs, Population Division. *World Population Ageing 2013*. ST/ESA/SER.A/348, (2013), accessed February 28, 2022, https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2013.pdf

7 HKCSD, Population Census Summary Results. *Hong Kong: Census and Statistics Department*, (2011), accessed March 16, 2022, https://www.censtatd.gov.hk/en/scode170.html

8 HKCSD, Hong Kong Population Projections 2015-2064. *Hong Kong: Census and Statistics Dept,* (2015), accessed March 18, 2022, https://www.statistics.gov.hk/pub/B1120015062015XXXXB0100.pdf

[9] Ernest Chui, “Ageing in Place in Hong Kong—Challenges and Opportunities in a Capitalist Chinese City,” *Ageing International,* 32, 167–182 (2008), https://link.springer.com/article/10.1007/s12126-008-9015-2

[10] “Private building database 2022,” Home Affairs Department, HKSAR, accessed January 24, 2022, https://bmis2.buildingmgt.gov.hk/bd_hadbiex/content/searchbuilding/building_search.jsf.

[11] Victor Ting, "To mask or not to mask: WHO makes U-turn while US, Singapore abandon pandemic advice and tell citizens to start wearing masks," South China Morning Post, April 4, 2020, accessed January 24, 2022, https://www.scmp.com/news/hong-kong/health-environment/article/3078437/mask-or-not-mask-who-makes-u-turn-while-us

12 Nadia Lam, Victor Ting, “Care home vaccination drive ‘Aimed’ at protecting elderly,” South China Morning Post, October 2, 2021, accessed January 24, 2022, https://alabama.ebscoed.com/eds/detail?db=edsggo&an=edsgcl.677713381

[13] Jenny Yue Yan Leung et al., “Private nursing home residents in Hong Kong - how frail are they and their need for hospital services,” *Journal of Hong Kong Geriatric Society.* 10(2). 65-69, (2000), accessed April 14, 2022, https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.457.2350&rep=rep1&type=pdf

[14] “Integrated Continuum of Long-term care- providing access to long-term care for older people,” Ageing and Health Unit, WHO*,* (2020), accessed January 29, 2022, https://www.who.int/teams/maternal-newborn-child-adolescent-health-and-ageing/ageing-and-health/integrated-continuum-of-long-term-care

[15] “List of RCHE,” Social Welfare Department, HKSAR, accessed January 18, 2022 https://www.swd.gov.hk/en/index/site_pubsvc/page_elderly/sub_residentia/id_listofresi/

[16] “Social Services and Benefits for the Elderly,” Housing & Social Services, HKSAR, accessed January 20, 2022, https://www.gov.hk/en/residents/housing/socialservices/index.htm

[17] “Hong Kong home prices rise for 13th straight year, with rising trend likely to sustain if city brings fifth wave of Covid-19 outbreak under control,” South China Morning Post, January 27, 2022, accessed January 28, 2022 https://www.scmp.com/business/article/3164915/hong-kong-home-prices-rise-13th-straight-year-rising-trend-likely-sustain

[18] Rachel E. Jordan, Peymane Adab, Kar Keung Cheng, “Covid-19: Risk factors for severe disease and death,” BMJ, vol. 368, article m1198, (2020), https://www.bmj.com/content/368/bmj.m1198

[19] Zhang Jixiang, Wang Xiaoli, Jia et al., “Risk factors for disease severity, unimprovement, and mortality in covid-19 patients in Wuhan, China,” Clinical Microbiology and Infection, vol. 26, no. 6, pp. 767–772, (2020), https://doi.org/10.1016/j.cmi.2020.04.012

[20] Dana-Claudia Thompson, Madalina-Gabriela Barbu, Cristina Beiu, Liliana Gabriela Popa, Mara Madalina Mihai, Mihai Berteanu, Marius Nicolae Popescu, "The Impact of COVID-19 Pandemic on Long-Term Care Facilities Worldwide: An Overview on International Issues", BioMed Research International, vol. (2020), Article ID 8870249, https://doi.org/10.1155/2020/8870249

[21] Sonit Bafna, Kinsuk Maitra, Yoonjeong Lim, Manasi Shah, Yi-An Chen, “Association Between Home Layout Connectivity and Cognitive Ability in Community Dwelling Older Adults: Implication for Occupational Therapy”. Journal of Design for Resilience in Architecture and Planning 2, 2021. (Special Issue: Space Syntax). Istanbul, TR:18-33, https://doi.org/10.47818/DRArch.2021.v2si033

[22] Stefano Capolongo, Marco Gola, Andrea Brambilla, Alessandro Morganti, Erica Isa Mosca, and Paul Barach, “COVID-19 and Healthcare Facilities: A Decalogue of Design Strategies for Resilient Hospitals,” Acta Biomedica Atenei Parmensis 91 (9-S):50-60, (2020), https://doi.org/10.23750/abm.v91i9-S.10117

[23] Mohana Das, “COVID-19 and the Elderlies: How Safe Are Hong Kong's Care Homes?,” Frontiers in Public Health, Vol 10. 2022. Article ID 883472, https://doi.org/10.3389/fpubh.2022.883472

[24] Alexandra Jayeun Lee, *Resilience by Design*, (Springer International Publishing, Switzerland, 2016), 34-38, https://doi.org/10.1007/978-3-319-30641-4

## BIBLIOGRAPHY


The Government of HKSAR, Press Release Hong Kong population projections for 2017-2066, accessed January 24, 2022, https://www.info.gov.hk/gia/general/201709/08/P2017090700379.htm

Health and Retirement Study, accessed March 12, 2022, https://hrsparticipants.isr.umich.edu/

Survey of Health, Ageing and Retirement in Europe, accessed March 01, 2022, http://www.share-project.org/home0.html

United Nations, World Population Prospects: The 2010 Revision, accessed February 25, 2022, https://population.un.org/wpp/

World Health Organization Study on global Aging and adult health (SAGE), accessed April 02, 2022, https://apps.who.int/healthinfo/systems/surveydata/index.php/catalog/13

U.S. National Institute on Aging, accessed March 18, 2022, http://www.nia.nih.gov/

Global Health and Ageing, WHO, accessed April 02, 2022, http://apps.who.int/iris/bitstream/handle/10665/186463/9789240694811_eng.pdf

Edmunds, H. The Focus Group Research Handbook. Lincolnwood, 1999, III.: NTC

Hong Kong population projections for 2017-2066 released [8 Sep 2017], accessed January 22, 2022, https://www.censtatd.gov.hk/en/press_release_detail.html?id=4200

Hong Kong or Seoul – which is the world’s most vertical city? *The Guardian*, August 20, 2019, accessed January 22, 2022, https://www.scmp.com/magazines/style/tech-design/article/3023394/hong-kong-or-seoul-which-worlds-most-vertical-city?module=perpetual_scroll_0&pgtype=article&campaign=3023394

Press release. HKSAR released [20 June 2018], accessed January 24, 2022, https://www.info.gov.hk/gia/general/201806/20/P2018062000367.htm

Center for Disease Control and Prevention. Responding to coronavirus (covid-19) in nursing homes, modified on February 2, 2022, https://www.cdc.gov/coronavirus/2019-ncov/hcp/nursing-homes-responding.html.

Resilient Design Institute, The Resilient Design Principles, accessed January 28, 2022, https://www.resilientdesign.org/the-resilient-design-principles/

National Institute on Aging, U.S. Department of Health & Human Services, accessed March 25, 2022, https://www.nia.nih.gov/research/dbsr/global-aging

# A CASE STUDY OF THE EFFECTS OF LIGHTING SIGN ON THE USE OF TOILETS BY PEOPLE WITH DEMENTIA

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## INTRODUCTION

In recent years, Japan's population has been aging. The number of elderly people, living alone is also increasing. The elderly care for the elderly with dementia at home. Increasing proportion of long-term care at home without entering the elderly home.

In 2021, 29% of the Japanese population will be over 65 years old[1], of which 18% of the elderly are recognized as dementia. People with dementia have difficulty in daily life and social life due to memory and attention deficits. In this study, we aim to reduce these difficulties by improving the living environment.

We conducted an interview survey in a group home for dementia patients, and found that there was a problem of users accidentally opening the door while others were using the bathroom. In addition, there were some problems such as being confused in the middle of the night because they did not know where the restroom was, or forgetting to turn on the light at night and using the restroom in the dark, making the surroundings dirty. Nursing in the toilet brings the caregiver more workload and recognized as most frequent task. The authors are exploring housing design in a super-aging society.

From the various interviews, this time we focused on how to prevent people from accidentally opening the door of a toilet being used by others, and renovated the toilet door as a means to solve the problem. We think that low-cost, easy-to-use improvements without the use of electronic or high-tech devices will really help.

### Relationship with previous studies

The relationship between dementia and the living environment has been investigated and proposed. Based on practical research, ADI[3.4] has compiled examples of design practices for improving the living environment in homes and care facilities for older people with dementia

The DSDC at the University of Stirling, for example, has compiled a set of guidelines based on research to date, and is using these as the basis for its building plans. [5] In Japan, real estate developers are using these guidelines to build rental housing for older people. In a 1998 study, a study related to toilet doors Amamiya et al.[10]conducted an experiment on visual perception of doors in elderly people with dementia to facilitate the perception of places that are necessary for daily life, such as toilets, and conversely, to avoid approaching dangerous places. The results showed that there was no difference in recognition based on color, and the visibility of the view beyond the door increased the response to

enter. The report also states that posters such as "under construction" and "dangerous" are less effective in discouraging traffic.
On the other hand, Oida[11] and Tanaka et al. are conducting research dealing with the guidance effect of people with dementia on the room display and toilet display of residents in nursing homes. A questionnaire survey was conducted among the staff of nursing homes across Japan to find out the actual situation of postings indicating locations and their effectiveness in guiding residents. Many facilities use letters on nameplates in front of private rooms and letters and pictograms on restroom doors, and the results showed that the use of letters was particularly effective in guiding residents. Based on a survey of many facility staff, it was found that the private room and toilet signs for people with dementia have a certain effect on wayfinding. However, no other study has attempted to achieve a wayfinding effect by using room light to make the signage more conspicuous.
Toilets are said to be one of the three most important nursing care areas in Japan, and are considered to be the most troublesome. In research related to the use of restroom spaces by people with dementia, for example, Oida[11] et al. conducted interviews with both caregivers to determine the effectiveness of recognizing letters and pictograms for signage at restroom entrances to reduce the wandering behavior of elderly people with dementia in facilities. Most of the caregivers answered that it was effective to brighten the display surface with light and place o large letters and pictograms on the "door surface" in order for the residents to recognize it well.
In this study, a group home for people with dementia was used as a research site to experiment with refurbishing toilet doors to make it easier for people to find the toilet and know that it is in use.

## METHOD OF RESEARCH

In this study, we focused on a display window installed on the toilet door to confirm that the door is "in use," and tried to improve the toilet door using a simple method without using IoT devices. In order to reduce errors and confusion caused by dementia, we developed a prototype of a door that conveys information by using a motion-sensitive automatic light switch in the toilet and ceiling lighting to make the "in use" text appear like a shadowgraph when other people are using the door. We installed the door in a group home where elderly people with dementia live together for a months to verify its effectiveness. (fig.1)

*Figure 1. Research Field: resident room and the communal living room*

## Research Field

The facility is located on Awaji Island, close to Osaka, and is a steel-framed, 18-person private unit dementia group home with a floor area of 699m$^{2.}$ The facility is located in a rural area and is a community-based facility for the elderly of one village. The residents live together from the age when they can move around on their own.

The facility under study is a two-unit facility with nine residents on each side. The entrance hall and staff room are placed in the center of the facility, and the communal living room is located in the center. In this study, we improved the sliding toilet doors of two toilet facilities, a 3㎡ toilet and a 6㎡ wheelchair toilet, for five residents of the nine rooms in the right side unit.(fig.2)

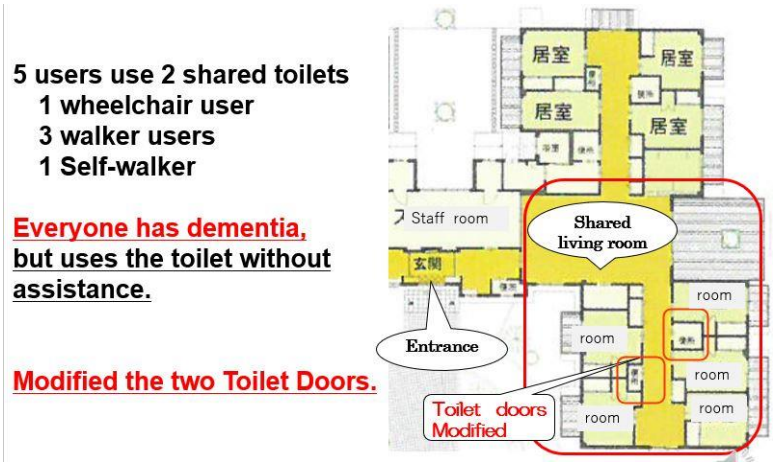


*Figure 2. Research Field: Floor plan and resident profile*

Group homes are community-based services that are often built in villages by private operators such as social welfare corporations. They provide care for the elderly with dementia in the form of daily living such as bathing, toileting, meals, and leisure activities, as well as rehabilitation training to restore their physical functions. The government has set standards for the establishment of such facilities, and they must be set up in all private rooms with 5-9 residents as a unit.(fig.2)

In Japan, where the land area is small, the floor space standard for a single room in a dementia-friendly group home is 7.43 square meters or more. The maximum number of residents is 18, with at least six nursing staff providing care for 18 residents during the day and two or more at night.

Due to the small floor space, many of them do not have toilets in their private rooms. The facilities surveyed do not have toilets in each private room, and only washbasins are installed in the private rooms. Because of its location in a rural area, the area of each private room is about 10 square meters per person.(fig.3)

*Figure 3. Research Field: Toilet Doors and Toilet*

In the nursing care unit, which is the target of this trial, two toilets are shared by five users. One user uses a wheelchair, three use a walker, and one uses a cane. All the users move around to use the toilet by themselves. The main flow line of the residents are from each room to the toilet and back, and from the common room to the toilet. Observations showed that most of the time of use tended to be before breakfast, after lunch and after dinner.

### How to notify when the toilet is in use

The purpose of this trial is to prevent people from accidentally opening the door of the toilet while someone else is using it.: (1) Change the position of the light window to a lower position where elderly people who tend to walk with their backs turned down can easily notice it. (2) Install a large light window with a large "in use" sign when the light is on. (3) Change to lighting that automatically turns on and off when the user enters the room. In this renovation, aluminum sliding doors were remanufactured and installed. (Fig 4) The details are described below.

### Trial1. Improvement of the mounting position of the lighted sign window

A light window is a small window installed in a door to let light into the room or to tell how the room is being used, and is often installed in the upper part of the door, either on the left or right side. On the other hand, people with dementia are more likely to miss these small windows due to their reduced attention span. In addition, elderly people tend to bend their backs and look at the floor or their feet more often, which also causes them to miss the small windows at the top.

The door of the toilet in this facility is a sliding aluminium door with a width of about 1m and a height of 2m, which is very commonly used in elderly care facilities and hospitals. In this facility, the door used for the toilet has a 150 mm square light window in the upper left corner. In this renovation, the window was moved closer to the door handle, where it would be easier for the elderly to see, and extended to 150 mm x 300 mm in size (Fig. 4). The shape of the window is rectangular because it is intended for writing Chinese characters.


*Figure 4. Lighted sign window improvement*

### Trial2. Project shadow letters on glass with lighting 2-1 Finding a suitable resin plate

As a trial to convey the information of "Toilet in use" by a simple method without using IOT devices such as displays or speakers linked to sensors, we made the Chinese character "In use" appear like a shadow picture when the lighting in the toilet is turned on and off. For this purpose, it was necessary to select the type of translucent resin plate for the glass surface of the light window. (Fig. 5)

The surface treatment of the resin boards and the different transmittance materials were compared in the laboratory using test pieces and a lighting box. Specifically, we compared the following three types of acrylic and polycarbonate materials and a total of seven translucent resin sheets with different transmittance rates ranging from 55.2% to 91.1%.

If the light transmittance is too low, even when the lighting is on, the contrast between the light and dark of the letters and the background is too low to be recognized as letters. On the other hand, if the light transmittance is too high, the shadows of people in the toilet room will be visible on the surface of the resin board, violating the privacy of people using the toilet. Based on preliminary verification in the laboratory, the best results were obtained when using the following 3) Kasumi 86.2% (made of polycarbonate resin).

Translucent acrylic (milky-white): 55.2%, 86.2%

The resin itself is semi-transparent, almost white, with a smooth surface. The thickness is 3 mm.

2) Matte acrlic (cloudy-white surface): 53.2, 67.6%, 79.3%

The surface of the transparent base resin has small irregularities and looks like frosted glass.

The thickness is 3 mm.

3) Enbossed patterned polycarbonate plate : 86.0%, 91.1%

The surface of the transparent base resin is wavy and moulded with a large uneven pattern which diffusely reflects light. The thickness is 3 mm.

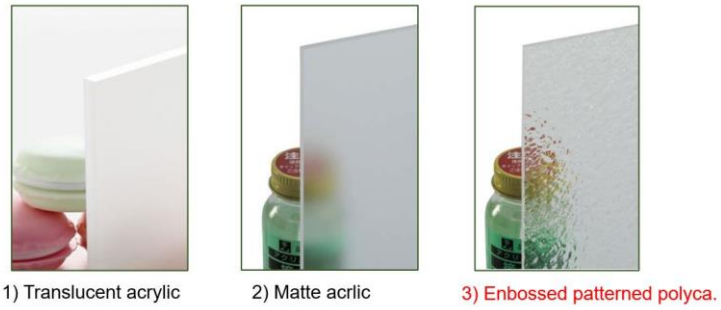


*Figure 5. Finding a suitable resin plate*

Next, we printed grey-toned letters on high-quality paper to be pasted on the light window, cut them out using a laser cutter and pasted them on the inside. Three types of candidate letter colours were prepared: 50%, 70% and 100% density. The results were also compared in an actual toilet. As the wallpaper inside the toilet cubicle was beige and the surface colour was relatively bright when looking at the light window from the corridor when the lights were off, 50% density was the most suitable letter colour.

The results showed that the colour of the bathroom walls and the brightness of the room when the lights were switched off were major factors. The best way was to match the grey-toned paper to the actual place of use. The text displayed was "in use" in Chinese characters in Helvectica Rounded font 200P emphasis. (Fig. 6)


*Figure 6. "in use" text appear like a shadowgraph*

### Trial3. Automatic lighting with infrared automatic lighting switch

Preliminary interviews at the facilities revealed that many users forget to turn off the lights in the toilets, and conversely, some users do not turn on the lights and use the toilets in total darkness, making the surroundings dirty. In addition, some users, both men and women, leave the door open to use the toilet because they find it cumbersome to close it.

We thought that automatic lighting would be an effective remedy for these situations. The manual wall switch in the toilet room was replaced by a motion-sensitive automatic lighting switch, which automatically illuminates the word "in use" when the toilet is in use. (Fig. 7)

The infrared sensor switch used in this project, the Panasonic WTP1811WP, has a detection range of ~2 m. The detection angle has been adjusted so that it can detect people in the toilet compartment only, without reacting to people in the corridor. By default, the light/dark sensor is switched off, so that the system detects people at any brightness level. After leaving the lavatory, the lights were set to turn off in 15 seconds, the shortest possible time.


*Figure 7. Make lighting automatic*

## RESULTS AND DISCUSSION

One month after the renewal, we interviewed the facility staff about the usability of the new display window and the situation of users, and received the following comments.

(1) Before the renovation, one person used to open the door to see if the toilet was in use even when the light was on, but now, when he sees the "in use" sign, he moves to another toilet without opening the door.

(2) The change in the position of the display window is easy to understand because users always look at the position of the puller and put their hand on it. There were no problems associated with the change in the position of the window.
(3) The new letter sign and the position of the display window did not cause any particular problems in use.
(4) No confusion arose because the letters on the sign could be read when the lights were switched off.
(5) The 'in use' sign was well understood by occupants.
On the other hand, we found some new problems with the introduction of motion detection lighting.
(1) Due to the nature of the infrared motion sensor, the light turns off if the user does not move for a while on the toilet. In the case of elderly people's facilities, many of them take a long time to defecate and do not move for a long time on the toilet seat.
(2) In addition, with a standard infrared motion sensor, the lights turn off after a 30-second delay after the user leaves the room., and the fact that the lights do not automatically turn off immediately caused two users with dementia to repeatedly touch the wall switch in an attempt to turn off the lights. And,one user complained that it was a waste of electricity because she could not turn off the lights immediately after leaving the room. It was found that the introduction of automatic lighting in the homes of people with dementia can cause confusion.
(3) Users in the corridor outside the door, even if the toilet is unoccupied, may mistakenly believe that the toilet is still in use as long as the display window is lit, causing them to wait for a long time without using the toilet.
(4) The lighting used can be adjusted to how long the lights stay on after the user has left. However, if this time is set long enough to ensure that the lights do not go out during use, they will not go out immediately after the user has left. In order to turn off the lights quickly after the user has left the room, it has been shown that a motion sensor is needed to detect more subtle movements.

## CONCLUSION

The results show that the change of the position of the light window and the use of shadowgraphic signs with indoor lighting have a certain effect in the case of this elderly care facility.
On the other hand, in this practice we were able to use the text signs effectively because the users understood the text correctly, but if they do not understand the text correctly we should consider using pictograms or illustrations instead of text.
However, as there is no pictogram to indicate that the toilet is currently in use, it is a matter for future work to determine what kind of pictogram or illustration would best convey the intention.
For the new issue of automatic lighting, a sensor that detects small movements of the person using the light is effective. We are working on a prototype motion sensor device that does not turn off the light while the user is sitting on the toilet seat, but turns it off very shortly after leaving the room.
We also believe that a method of adding a switch to override the automatic part of the light by manual operation by a person to turn it off would be effective in preventing confusion. We would like to continue to test the usability of lighting window that also serve as display signs.
As part of our future work, we would like to further explore the possibilities of easy-to-use low technology, such as the one described here, to help the lives of older people with dementia and to research methods to reduce stress for them, their families and carers.

## ACKNOWLEGEMENTS

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## NOTES

[1] Cabinet Office, Government of Japan, *Annual Report on the Ageing Society FY 2021*, (Tokyo:Nikkei Printing, 2021.6).
[2] Cabinet Office, Government of Japan, *Annual Report on the Ageing Society FY 2017*, (Tokyo:Nikkei Printing, 2017. 7).
[3] Alzheimer's Disease International, *World Alzheimer Report 2020: Design Dignity Dementia: dementia-related design and the built environment Volume 1,* (Illinois+London: 2020 Alzheimer's Disease International).
[4] Alzheimer's Disease International, *World Alzheimer Report 2020: Design Dignity Dementia: Case Studies:dementia-related design Volume 2,* (Illinois+London: 2020 Alzheimer's Disease International).
[5] See: University of Stirling DSDC (2012) Designing interiors for people with dementia, published by Publishing Bureau; Dementia Service Development Center, 10 Helpful Hints for Dementia Design at home (Stirling :published by University of Stirling, 2014); Dementia Service Development Center 10 Questions about the law and dementia in Scotland, (Stirling : published by University of Stirling DSDC, 2014); Dementia Service Development Center Eating, Drinking and dementia a pocket guide about nutrition ,( Stirling :Published by University of Stirling DSDC, 2015); Dementia Service Development Center 10 Tips on signage for dementia, (Stirling :Published by University of Stirling DSDC Building Research Establishment, 2017)[6] Dementia Service Development Center, *10 Helpful Hints for Dementia Design at home* (Stirling :published by University of Stirling, 2014).
[7] Dementia Service Development Center *10 Questions about the law and dementia in Scotland*, (Stirling : published by University of Stirling DSDC, 2014).
[8] Dementia Service Development Center *Eating, Drinking and dementia a pocket guide about nutrition* ,( Stirling :Published by University of Stirling DSDC, 2015).
[9] Dementia Service Development Center *10 Tips on signage for dementia,* (Stirling :Published by University of Stirling DSDC Building Research Establishment, 2017).
[10] Hiroko, Amamiya: *Experimental Research on Visual Recognition of Doors and Steps by Elderly Patients with Dementia*, (Geriatric & Gerontological Behavioral Sciences, Vol. 5),111-121.
[11] Tomomi Oida Naoto Tanaka.et al.: *The evaluation of the indication method of the toilet entrance by Elderly with Dementia and Care Worker, A Study on the Intelligibility in Nursing Homes Part 1*, (Tokyo:2009:Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan, E-1), pp. 1043-1044.

## BIBLIOGRAPHY

Amamiya Hiroko: *Experimental Research on Visual Recognition of Doors and Steps by Elderly Patients with Dementia*, (Geriatric & Gerontological Behavioral Sciences, Vol. 5).
Alzheimer's Disease International, *World Alzheimer Report 2020: Design Dignity Dementia: dementia-related design and the built environment Volume 1,* (Illinois/London: 2020 Alzheimer's Disease International).
Alzheimer's Disease International, *World Alzheimer Report 2020: Design Dignity Dementia: Case Studies:dementia-related design Volume 2,* (Illinois/London: 2020 Alzheimer's Disease International).
Cabinet Office, Government of Japan, *Annual Report on the Ageing Society FY 2021*, (Tokyo:Nikkei Printing, 2021.6).
Cabinet Office, Government of Japan, *Annual Report on the Ageing Society FY 2017*, (Tokyo:Nikkei Printing, 2017. 7).
Dementia Service Development Center, *10 Helpful Hints for Dementia Design at home* (Stirling :published by University of Stirling, 2014).
Dementia Service Development Center *10 Questions about the law and dementia in Scotland*, (Stirling : published by University of Stirling DSDC, 2014).
Dementia Service Development Center, *Eating, Drinking and dementia a pocket guide about nutrition* (Stirling: Published by University of Stirling DSDC, 2015).
Dementia Service Development Center, *10 Tips on signage for dementia,* (Stirling :Published by University of Stirling DSDC Building Research Establishment, 2017).
Oida Tomomi, Naoto Tanaka.et al.: *The evaluation of the indication method of the toilet entrance by Elderly with*

*Dementia and Care Worker, A Study on the Intelligibility in Nursing Homes Part 1*, (Tokyo:2009:Summaries of Technical Papers of Annual Meeting, Architectural Institute of Japan).

# RESPONSIVE INTERIOR SPACES AND DESIGNING THE NEW NORMAL

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## INTRODUCTION

Humans possess an innate affiliation with the natural world.[1] This intrinsic connection sets the basis for biophilic theory in design that attributes enhanced wellbeing to natural elements in inhabitable spaces. The majority of our lives take place within interior environments; thus, actively integrating biophilic elements such as plants in high-occupancy areas is essential to designing healthy settings. Ubiquitous to daily life, plants are proven to enhance psychological and physiological wellbeing. Interior vegetation metabolizes human respiratory products, increasing oxygen concentrations while directly contributing to the aesthetics of the space. However, plants can assume a more integral role in interior systems. While biophilic design elements directly contribute to a positive interior environment and have proven benefits to physical health, the manner in which greenery has been spatially integrated has often assumed a rather superficial presence by focusing primarily on aesthetic value. It is essential to pursue a more performative agenda when it comes to interior plants, advancing their health benefits and improving the interior enclosure both aesthetically and functionally.

Incorporating performative systems with interior spaces assumes a pressing urgency amid the "new normal" imposed by the COVID-19 global pandemic, a circumstance where indoor air quality is among the chief concerns.[2] Herein, interior design and synthetic biology can work together to contribute to the built environment synergistically by introducing synthetically engineered sensing and reporting plants to interior spaces via the design of living green wall systems that serve as environmental sentinels. The ongoing COVID-19 pandemic placed an unequivocal demand on our interior spaces, warranting a reassessment of how we approach design and wellness. This paper features interdisciplinary research that leverages the requisite need for flexible, responsive, and healthy interior spaces. It examines the development of biotic systems employing plants and new fabrication methods to maximize the programmatic diversity of interior settings while prioritizing the overall health and wellbeing of the occupants.

## INTERIOR ECOLOGIES

In the book *Hypernatural: Architecture's New Relationship with Nature,* Blaine Brownell and Marc Swackhamer outline the human sentiments and actions towards the natural world. Regarding microbial matter in particular, they state that "Humanity's attitude toward the microbial sphere has roughly paralleled its consideration for nature in general: as an enigma and a threat, but also a boon."[3] The complexities and contradictions of this relationship can be seen directly in how we approach the

design of interior spaces. The relationship between nature and interior space is a rather complicated one. Interiors inherently enclose space severing it from the external elements; yet we strive to bring nature in small allowances back into our living spaces. Interior spaces host a variety of micro ecologies that evade the climate-controlled sealed bubble that we set out to create.

The biodiversity of interior spaces became front and center during the ongoing COVID-19 pandemic, albeit under the negative connation and repercussions of the deadly disease. As daily lives relocated entirely to the singular interior setting throughout lockdowns and quarantines, the complexities and intricacies of the interior biome became clearer as the realization of sharing our interior bubbles with a diverse plethora of living organisms and microbial matter emerged. Reactive fixes such as six feet demarcation lines, social distancing signs, transparent sneeze guards and partitions, flooded our spaces in response to this awareness. These responses paved the way for a more meaningful pursuit of new interior thinking compatible with these new realities. As such, the search for an innovative interiority that redefines the relationship between the human species, spaces, the interior biome, and nature at large has become vital. A paradigm shift focusing on interior ecologies is increasingly important as a portrait of this new normal emerges, ushering a shift in societal dynamics. On the brink of a new era of spatial practice, design is becoming more accountable to natural resources and adaptive to contextual parameters. Hence, conceiving interiors as green catalysts while fostering an alliance between nature and space is a public priority now more than ever.

## Advancing the Role of Plants in the Interior Volume

Most of our lives take place within interior environments. According to the United States Environmental Protection Agency (EPA), Americans spend about 90% of their time indoors[4], and that is prior to the pandemic's induced mobility restrictions. During the past decade, scientists recognized that building interiors house far more than inanimate objects, people, pets, and plants.[5] The built environment which formulates 0.5% of livable Earth is a microbiome incubator in a state of continuous evolution.[6] The unseen microbiome is composed of beneficial and harmful microbes that directly impact the indoor air and health of the occupants.[7] Nonetheless, microbial organisms are not typically acknowledged as part of the design process. While healthy interior spaces are vital under any circumstance, this matter assumes a pressing urgency amid the "new normal" imposed by the COVID-19 pandemic, where indoor air quality and the flexibility of interior spaces are among the chief health and design concerns. With the onset of the COVID-19 pandemic, a complete reliance was placed on interior spaces as everyone was encouraged to stay home to curb the spread of the virus. As all facets of everyday life abruptly transitioned to typically one multifunctional living area, approaching interiority with a cursory sensibility was no longer an option. Instead, an investment in adaptive spatial strategies that maximize the efficiency of our interior settings while contributing to health and wellbeing is now requisite.

There exists a robust body of research addressing the positive impact of interior vegetation. While biophilic design elements directly contribute to a positive interior environment and have proven benefits to physical health, how greenery has been integrated spatially has often assumed a rather superficial presence focusing primarily on aesthetic value. Integrating a more performative agenda with the existing aesthetic qualities of interior plants while augmenting their health benefits with the ability to actively monitor indoor air quality and enhance the interior enclosure both aesthetically and functionally is a design priority now more than ever. Within the provisions of new technologies and through transdisciplinary partnerships, biophilic elements can acquire a more active interior space function. The integration of such functions within the interior changes the assessment of interior plants while fostering a new approach towards biophilic design. Most importantly, it aids in the long-term mitigation of harmful microbial matter that pauses adverse effects on occupants.

*Figure 14 Speculative design for an office space that employs the green wall topographies to divide various programmatic spaces*

## TOWARDS PERFORMATIVE INTERIORS

The 2017 National Academies of Sciences, Engineering, and Medicine Report titled *"Microbiomes of the Built Environment: A Research Agenda for Indoor Microbiology, Human Health, and Buildings"* asserts the integral role building interventions can play in changing indoor microbiomes in ways that promote health.[8] Working towards this goal, the research and design proposal featured here utilizes synthetically engineered plants coupled with new fabrication methods that primarily rely on additive manufacturing to generate variable site-specific green wall configurations that can survey the quality of indoor air and improve the functionality of the interior space.

Plants with sensing and reporting capabilities actively and proficiently survey the interior air quality. As environmental sentinels, synthetically engineered plant-based sensors (phytosensors) can be designed as specific microbe detectors to warrant closer inspection of the interior air quality.[9] Plants sense pathogens at the molecular level, yielding an inducible fluorescent protein readout to signal detection.[10] These same proven strategies can be applied to detect the presence of the SARS-CoV-2 in the circulating indoor air. The research employs several phytosensors in the design and fabrication of site-specific green-wall systems. Additionally, it implements topographic surface variations that can be used for built-in furniture, acoustic control, or storage, among other usages, thereby catering to much-needed adaptability to living functions within interior spaces. The topography of the wall system enhances the plants' detection capabilities and the aesthetics and function of the living wall and the space at large.

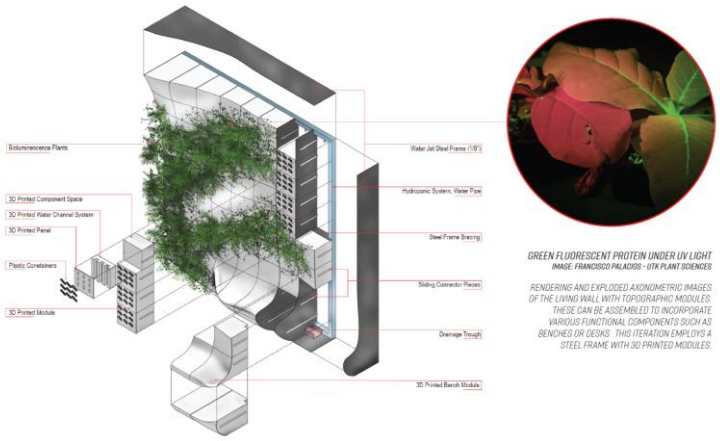


***Figure 15*** *L. Exploded axonometric image of the living wall with topographic 3D printed modules, source: by author. R. Green Florescent Protein Under UV light in a Nicotiana Tabacum plant that has been bioengineered to luminesce if it detects VOCs (Volatile Organic Compounds) in the air. The fluorescent green glow is an indicator of the presence of VOCs. Source: UTK Plant Sciences Department, image by Francisco Palacios*

## Living Frameworks

Real-time reporting of unwanted contaminants within the built environment, specifically interior spaces, holds invaluable ramifications to everyday life. The proposal utilizes additive manufacturing to generate variable site-specific green wall configurations. The system is entirely modular and interchangeable based on the users' needs. Coupling the biotic plant technology and advanced fabrication allows for the wall's customization encouraging direct exchanges between the occupant, the interior space, and the vegetation. 3D-printed growth substrates made out of plant-based biodegradable plastics (PLA) enable the design of innovative interior systems compatible with current needs. Furthermore, the plants are grown in modular containers, reconfigurable, and easily replaced if the need arises. In addition to sensing-and-reporting capacity, we are experimenting with implementing food production within the wall system. The multiple capabilities of the living green wall are summed up in its title. Interior walls can be living and lived-in; they can actively contribute to a multivalent healthy interior environment catering to changing spatial needs and conditions, actively and holistically promoting health and wellbeing.

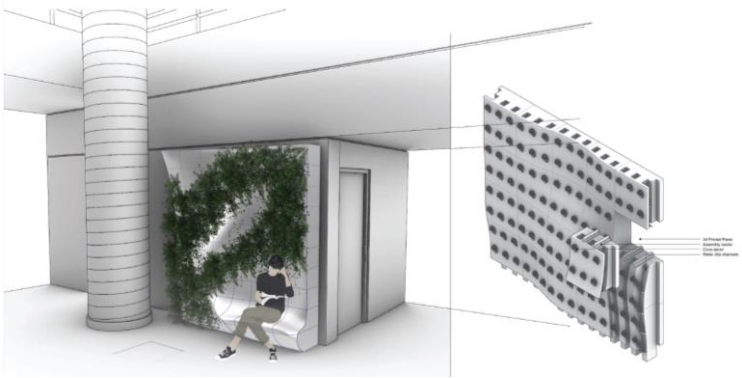

***Figure 16*** *Rendering and exploded axonometric images of the living wall with topographic modules. These can be assembled to incorporate various functional components such as benches or desks, source: by author*

The customization of the unit allows for direct exchanges between the occupant and the interior vegetation. It caters to its operability and multifunctionality within the space. Herein, interiority assumes a unique malleability formally and functionally, constituting a rethinking of the ontology of interior objects from static fixtures to living frameworks. On a practical level, utilizing 3D-printed components as growth substrates enables the design of innovative functional forms that are integral to the spatial resolution and experience. This approach to green wall systems provides several functionalities and can be assembled and reassembled in various configurations, thus, catering to the much-needed adaptability of interior spaces.

### The Potential Impact of an Interior Living Green Wall

While green walls are not novel systems, this research navigates new design opportunities within this design typology by combining air monitoring capabilities, biophilic benefits, and user interface. Electronic units on the market today are pricy, require constant maintenance, often depend on third parties for processing the results, have a limited range of coverage, and need strict environmental conditions for optimal function (such as low humidity, no sunlight exposure). In contrast, the living green wall requires low maintenance, does not rely on batteries or power sources, and can function in any environmental conditions. Most importantly, it enhances the indoor air quality and the interior spaces in ways that an electronic monitoring device cannot. The living green wall is multifunctional, resilient, can be easily fabricated and assembled in any setting, and directly corresponds to the evolving needs and narratives of the users.

Some of the characteristics that distinguish the living wall system from other green wall systems are:

1. *Air monitoring capabilities* the use of sensing-and-reporting plants adds to the exiting benefits of interior vegetation new functions that are of utmost importance now and in the future.
2. *Sustainability and flexibility*; the plants are grown in cone-shaped units that can be individually replaced if needed. It uses dirt that can be sourced from the site and does not rely on hydroponics, although it can be adjusted to do so. It can be manually watered and has built-in reservoirs to minimize the watering frequency and waste.
3. *Modularity and spatial adaptability*; the wall topography can be customized based on users' needs creating benches, storage, desk spaces, shelving, etc.
4. *Easy fabrication and assembly*; the living wall can be entirely 3D printed on-site using a standard 3D printer and PLA filament. Alternatively, it can also be designed to fit within conventional wall framing systems. It can be anchored to an existing wall or freestanding with optional casters for mobility.

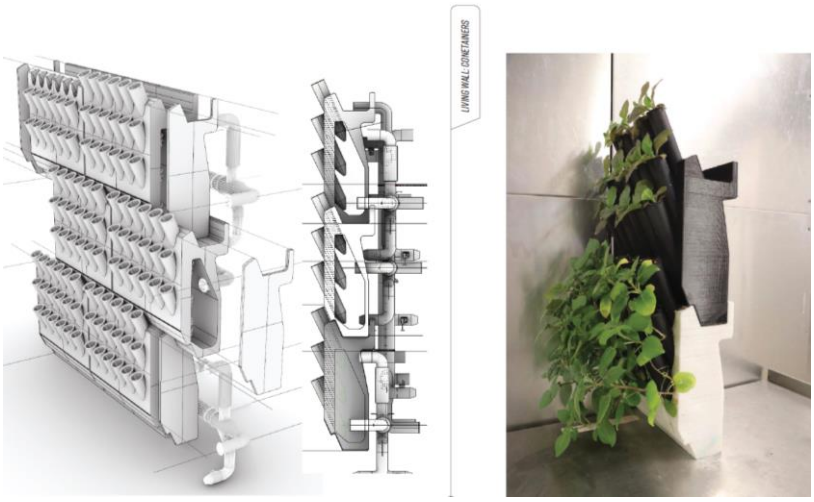


*Figure 17 L. Preliminary design explorations utilizing prefabricated growth cones placed in 3D-printed units. The modular interlocks and can be stacked in various configurations. R. The fabricated modular units planted with Nicotiana Tabacum plant, source: by author*

Monitoring indoor air quality via the living wall system offers a unique, dependable, and sustainable means of surveying the interior atmosphere while enhancing its quality. It is operable in any setting such as homes, offices, schools, hospitals, senior care facilities and can be deployed in remote sites such as refugee camps and shelters. The sensing-and-reporting vegetation can also be substituted or augmented with food-producing plants, imparting a true circular design approach to interior systems. Such circular approaches give us the tools to tackle biodiversity loss while addressing critical climate issues and social needs.[11] We are at a heightened moment of awareness about pertinent topics such as health, wellness, resilience, and sustainability— and our spaces need to be rethought according to these existential factors.

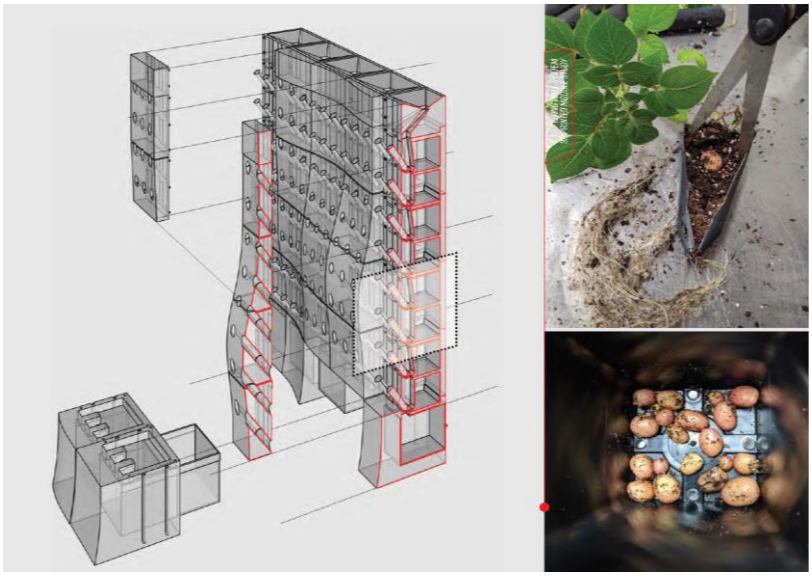

***Figure 18*** *R. an exploded axonometric of the living wall system using built-in reservoirs. L. potatoes grown and harvested for the living wall's prototype's containers, source: by author*

Resilience, wellness, and design can and should align in all our living spaces. Design strategies for prioritizing physical and mental wellbeing and longevity are central to our future. Precedents from past pandemics supported by current projections indicate that what we are experiencing today in regards to the COVID-19 pandemic is going to usher lasting changes to every aspect of our living.[12] According to leading design experts like Gensler, our spaces will have to change to accommodate users and prioritize their physical and mental wellbeing.[13] Under such an assessment, a multimodal living green wall becomes an integral component of interior settings. Moving forward, designers, scientists, and health experts must work together and be fully involved in the authorship of this new era coupling excellent and responsible design sensibilities. The future will offer us opportunities to rethink how we approach the built environment, particularly interior spaces, with a renewed commitment to health and wellbeing.

## PROGRAMMATIC MULTIPLICITY AND ACTIVE USER AGENCY

Interior space can foster both performance and productivity. As with health parameters, the multiplicity of the programmatic functions of space is integral to more sustainable and responsive living. The dynamics and timetable of interior spaces are changing as living, working, learning, and playing occur in the same settings. There is a requisite need to integrate within interiors adaptive systems to maximize their programmatic diversity. This is possible through the logistical integration of new technologies and natural systems enabling spaces to accommodate a range of activities while providing healthy and comfortable settings. Consequently, a paradigm shift in how we think about interiority involves transforming spatial elements from static objects to operational frameworks. Such frameworks are capable of catering to a host of interior activities, but most importantly, they address interior space as a palpable microcosm of diverse occupants (humans, animals, plants, and microorganisms).

The interaction between spatial parameters and users is crucial in allowing the occupants to exercise agency over their settings and bi-directionally connect people to their physical surroundings.[14] A coalescence as such introduces tangible, resilient, and adaptive solutions to interior settings that promote the occupants' health and advance their agency in customizing their interiors. Moreover, it also improves functionality through the adaptation of spaces. Interiors have been overlooked when it comes to resiliency and sustainability in the built environment as the tendency is to focus externally or topically on architecture. Retooling space from the inside out demonstrates that interiors can introduce and cultivate a user-driven resilience and contribute with other strategies to climate action. Moreover, interior spaces are the settings where user engagements and actions directly take place, forming daily habits and practices and directly impacting health, wellbeing, and productivity.

## CONCLUSION

It is essential to underscore that integral changes in the built environment, such as indoor plumbing and ventilation, have often been in response to health concerns.[15] Today, we find ourselves at a nexus between a complex field of social relations, pressing health realities, and changing ecological systems. Norms are changing in response to local and global shifts, health and climate concerns, scarcity of resources, and a general ethos of instability. Projects reflecting on the relationship between architecture and nature at a time when the human impact may have reached a tipping point are vital for forging a resilient future. We are at a heightened moment of awareness about health and wellness — and our spaces need to be rethought accordingly. Wellness and design can and should align in all our living spaces. Design strategies for prioritizing physical and mental wellbeing are central to our existence, guiding a new typology of interior systems that proactively engage space and support occupants.

As we enter the third year of a global pandemic that altered many parameters of life worldwide, creating interior systems that embrace contemporary lifestyles that combine nimble ways of working and agile living while contributing to health and wellbeing is a priority. While meeting future challenges necessitates a unilateral response to our built environment, interior spaces remain at the core of holistic placemaking in all its parameters. Multipurpose living interior systems such as the living wall bridge the gap between design values and the biodiversity of the spaces we occupy. They also pave the way for new legacies of exchange between architecture and nature.

## NOTES

[1] Edward O. Wilson, *Biophilia* (Cambridge: Harvard University Press, 1984).
[2] Sasha Wedekind, "Covid-19 Catapults Indoor Air Quality To Top Of The List," Forbes Magazine, June 10, 2020, https://www.forbes.com/sites/pikeresearch/2020/06/10/covid-19-catapults-indoor-air-quality-to-top-of-the-list/.
[3] Blaine Brownell and Marc Swackhamer, eds., *Hypernatural: Architecture's New Relationship with Nature* (New York: Princeton Architectural Press, 2015), 90, http://ebookcentral.proquest.com/lib/utk/detail.action?docID=4514024.
[4] "Indoor Air Quality," EPA, accessed January 23, 2022, https://www.epa.gov/report-environment/indoor-air-quality#note1
[5] C. Neal Stewart, Jr. et al. "Houseplants as Home Health Monitors." *Science (American Association for the Advancement of Science)* 361, no. 6399 (2018): 229–230.
[6] Stewart, "Houseplants," 229–230.
[7] Stewart, "Houseplants," 229–230.
[8] National Academies of Sciences, Engineering, and Medicine, *Microbiomes of the Built Environment: A Research Agenda for Indoor Microbiology, Human Health, and Buildings* (Washington, DC: The National Academies Press, 2017), 8, https://doi.org/10.17226/23647.
[9] Stewart, "Houseplants," 229–230.
[10] Stewart, "Houseplants," 229–230.
[11] Ellen MacArthur Foundation, *The Nature Imperative: How the circular economy tackles biodiversity loss* (2021), 17, https://ellenmacarthurfoundation.org/biodiversity-report.
[12] Linda Poon, "How Our Behavior Will Change After the Pandemic," Bloomberg, May 26, 2020, https://www.bloomberg.com/news/features/2020-05-26/how-our-behavior-will-change-after-the-pandemic.
[13] Strategies to prioritize physical and mental health are suggested in two articles by Gensler from their website's Dialogue Blog: Research & Insight. The first by James Wynn and Richard Tyson, "Creating Data-Rich Workplaces to Detect and Curb Viral Transmission," and a second by Donya Farhangi, "Designing Spaces to Help People Feel Emotionally Safe in the Workplace."
[14] Aneta Wierzbicka, et al, "Healthy Indoor Environments: The Need for a Holistic Approach," International Journal of Environmental Research and Public Health, vol. 15, no. 9, MDPI, 2018, 1874, https://doi.org/10.3390/ijerph15091874.
[15] Naglaa A. Megahed, and Ehab M Ghoneim, "Antivirus-built environment: Lessons learned from Covid-19 pandemic," Sustainable cities and society Vol 61 (2020): 102350, 1, doi:10.1016/j.scs.2020.102350.

## BIBLIOGRAPHY

Brownell, Blaine, eds. *Hypernatural: Architecture's New Relationship with Nature*. New York: Princeton Architectural Press, 2015. http://ebookcentral.proquest.com/lib/utk/detail.action?docID=4514024.

Ellen MacArthur Foundation. *The Nature Imperative: How the circular economy tackles biodiversity loss* (2021). https://ellenmacarthurfoundation.org/biodiversity-report.

EPA. "Indoor Air Quality." Accessed January 23, 2022. https://www.epa.gov/report-environment/indoor-air-quality#note1.

Farhangi, Donya. "Designing Spaces to Help People Feel Emotionally Safe in the Workplace: Dialogue Blog: Research & Insight." Gensler. June 19, 2020. https://www.gensler.com/research-insight/blog/designing-spaces-to-help-people-feel-emotionally-safe-in-the.

Megahed, Naglaa A, and Ehab M Ghoneim. "Antivirus-built environment: Lessons learned from Covid-19 pandemic." Sustainable cities and society Vol. 61 (2020): 102350. doi:10.1016/j.scs.2020.102350

National Academies of Sciences, Engineering, and Medicine. *Microbiomes of the Built Environment: A Research Agenda for Indoor Microbiology, Human Health, and Buildings*. Washington, DC: The National Academies Press, 2017. https://doi.org/10.17226/23647.

Poon, Linda. "How Our Behavior Will Change After the Pandemic." Bloomberg, May 26, 2020. https://www.bloomberg.com/news/features/2020-05-26/how-our-behavior-will-change-after-the-pandemic.

Stewart, C. Neal Jr, Rana K Abudayyeh, and Susan G Stewart. "Houseplants as Home Health Monitors." *Science (American Association for the Advancement of Science)* 361, no. 6399 (2018).

Wedekind, Sasha. "Covid-19 Catapults Indoor Air Quality To Top Of The List." *Forbes Magazine*, June 10, 2020. https://www.forbes.com/sites/pikeresearch/2020/06/10/covid-19-catapults-indoor-air-quality-to-top-of-the-list/.

Wierzbicka, Aneta, et al. "Healthy Indoor Environments: The Need for a Holistic Approach." International Journal of Environmental Research and Public Health, vol. 15, no. 9, MDPI, 2018. https://doi.org/10.3390/ijerph15091874.

Wilson, Edward O. *Biophilia*. Cambridge: Harvard University Press, 1984.

Wynn, James, and Richard Tyson. "Creating Data-Rich Workplaces to Detect and Curb Viral Transmission: Dialogue Blog: Research & Insight." Gensler. April 15, 2020. https://www.gensler.com/research-insight/blog/creating-data-rich-workplaces-to-detect-and-curb-viral.

# THE DEVELOPMENT OF A PROMPTING SYSTEM FOR THE ELDERLY WITH DEMENTIA WHICH IS EASY TO INSTALL: WHITEBOARD-STYLE DEVICE WHICH CONVEYS INFORMATION USING LIGHT AND SOUND

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## INTRODUCTION

According to the Annual Report on the Ageing Society FY2021, in Japan, the number of elderly people aged 65 and over in 2020 accounted for 28.8% of the total population, and even as the total population declines, people aged 65 and older are growing in number, with it being calculated that they will reach 33.3% of the total population in 2036.[1] In addition, the number of elderly people with dementia is increasing together with the ageing of Japanese society, and they are expected to reach around 7 million in 2025. In the early stages of Alzheimer's disease, one of the causes of dementia, forgetfulness is often seen. When major problems occur due to forgetfulness such as the loss of a bank passbook or improper disposal of a lit cigarette, the actions of the relevant person are frequently restricted, which is liable to lead to a further decline in the amount of physical activity that person gets. Further, Miwa et. al. indicate that the use of automated systems can bring about disuse atrophy not only in terms of physical function but in cognitive function as well.[2] It is conceivable that an effective means of lifestyle continuation at this stage is an approach which prevents mistakes before they happen through the use of physical aids such as notes and information signs, as well as through environmental adjustments which improve visibility. In addition, increasing the degree of independence is expected to reduce the burden of caregiving while at the same time maintaining a person's self-esteem that there are still things they can do themselves.

There has been a great deal of research on the development of living spaces that take into account the needs of the elderly with dementia. World Alzheimer Report 2020 of Alzheimer's Disease International looks at design in home/domestic settings, day and residential care, hospitals and public buildings and spaces, and makes a strong statement that design for dementia is 30 years behind the physical disabilities movement – and that this must change.[3] And also, The Dementia Service Development Centre (DSDC) at University of Stirling conducts a variety of research on the design of dementia-friendly living environments for the elderly, as well as education on dementia care and certification of outstanding facilities to disseminate these findings.[4,5] As a study on the development of signs to prevent residents from getting lost while moving to their rooms or restrooms in elderly care facilities in Japan, Mizuno et al. investigated what kinds of objects were installed as signs for rooms

in group homes and conducted a behavioral observation experiment with 23 elderly people with dementia. They reported that signs with the names of residents or the rooms were effective in preventing moderate participants from getting lost, but illustrations and pictograms had no such effect.[6,7]

On the other hand, research on the introduction of assistive technologies such as IoT into the living space of elderly people has been conducted using a variety of approaches. Camp et al. have conducted a systematic review of the use of technology for the recognition of Activities of Daily Living (ADL) in the home environment of the elderly, and reported that it can be categorized as using environmental and wearable technology, wearable technology only, or environmental technology only.[8] Neal et al. have conducted a systematic review of digital technologies used by people with dementia to improve self-management and social participation, and identified weak evidence that digital technologies may provide less benefit to people with dementia than people with MCI.[9] Boumpa et al. have proposed an acoustic-based person recognition support system using smart speakers placed in each room and smart devices such as smartphones and smart wristbands to help people with dementia recognize their family members for better interaction and collaboration.[10] Noda et al. have proposed a support system for people who have difficulty properly separating and disposing of their garbage by recording the person's garbage with a video camera and sending the video to a third party in another location and having this third party confirm garbage separation before it is thrown out.[11]

We have developed an "auto cue system" in which multiple sensors are installed in a room to detect what a subject is doing and prevent mistakes before they happen by providing voice prompts at suitable times.[12,13] The aim of this system is to prompt action by the subject by, for example, conveying to them that they have forgotten to turn the lights out in a room or by playing a voice message not to forget to lock the door just before going out, without doing the actions in place of the subject (such as turning out the lights for them or automatically locking the door, etc.).

Conversely, in the authors' previous researches, the complexity of the work involved, such as the combination of sensors and selecting their installation locations, and adjusting parameters to suit the subject, was a challenge. In addition, while voice-based prompts engendered familiarity, the information was not transmitted by one hearing failure of the prompts if there was no way to listen again.

In this paper, we propose maintaining the prompt concept while combining the sensor component and prompt unit, and at the same time using a whiteboard-style device to convey information via light and sound, installing the device in the home of an elderly person with dementia for a set time to investigate the results.

## METHOD

An overview of the system is shown in Figure 1. The system is comprised of a human detecting sensor (HiLetgo AM312 PIR sensor module), light units (NeoPixel-compatible LED tape), an audio playback unit (Kyoritsu Products KP-ISD1820), a speaker unit (4Ω3W, enclosed), a control unit (Adafruit Trinket), and a power unit. The human detecting sensor detects when a person approaches, after which the front of the board is made to flash a set number of times (at a frequency of 1Hz) to attract attention; at the same time, a pre-recorded message is played back. Note that the message can be selected per the characteristics of the subject, such as setting it to the same content as written on the board, or setting it to prompt reading of the board with a message like "Look at the board."

The board prototype we made is shown in Figure 2. The size of the entire unit is 260mm by 250mm (board size is 225mm by 220mm). The surface of the board's clear acrylic panel has been roughened, enabling the entire board to be lit more brightly using LED lighting provided from the sides than would be possible by lighting the board from the back. The detection range of the human detecting

sensor is a 3-5m in a cone less than or equal to 100 degrees. And also, a volume adjustment knob and a recording button are added so that family members of the subject can change the content of the recorded message by themselves.


*Figure 1. System overview.*

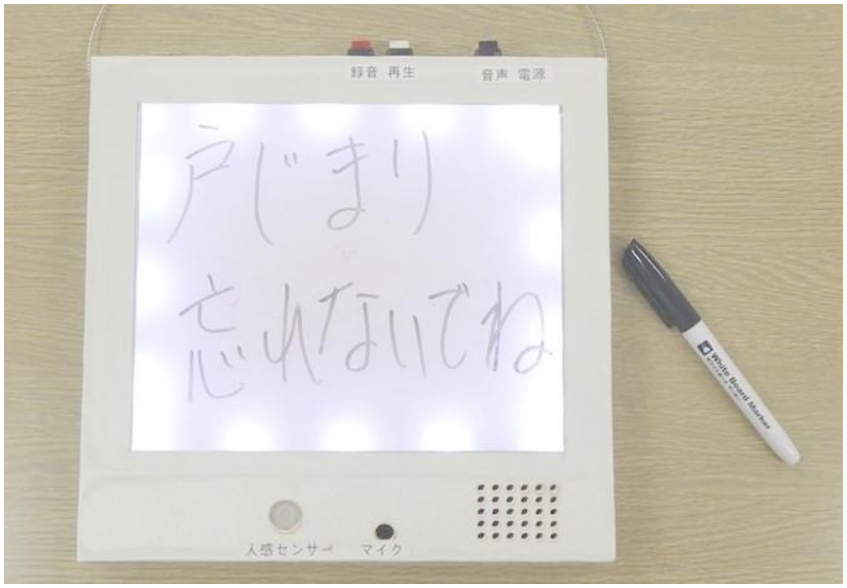

*Figure 2. The prototype system.*

## RESULTS AND DISCUSSION

Mrs. A (91 years old, female, Mini-Mental State Examination [MMSE] score of 20 out of 30, hard of hearing), who has Alzheimer's dementia, lives with her husband and eldest daughter. Mrs. A frequently enters her eldest daughter's room without permission, handling various items and shutting the window. Despite measures such as being warned by her daughter and posting a note not to enter the room, there was no improvement in this issue. In addition, Mrs. A is very forgetful, and will ask them same question over and over again. Note that as the family owns a cat, the door to the daughter's room is frequently left open. The daughter wanted to use this system to tell her mother not to enter her room without permission and shut the window, and so the board's written and voice message were both set to "Please don't shut the window!" The board was installed by hanging it from the window frame so that it would be at eye level, and the human detecting sensor was pointed at the entrance to the room such as Figure 3. The board was used when the daughter was absent from her room, and the

sliding door and the window was open at that time. She recorded whether the window was open or not when she returned to her room.

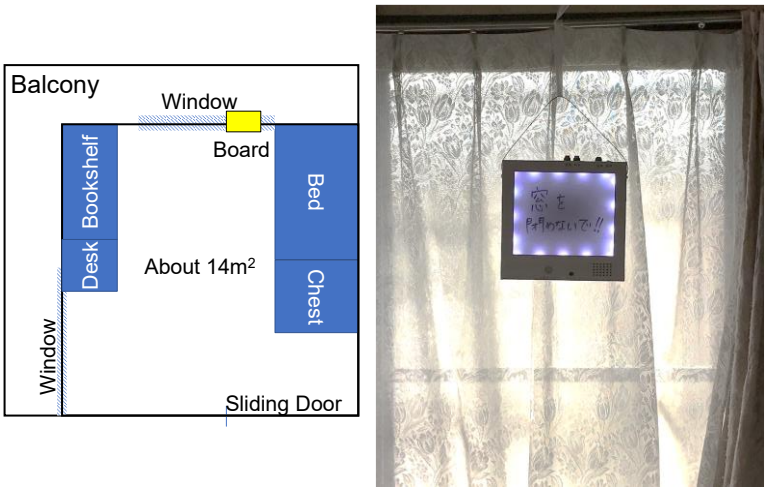


*Figure 3. How the prototype system was installed.*

The results of using the system over an approximately month-long period lasting from November 9, 2020 to December 11, 2020 are shown in Figure 4. 15 out of 30 times, the window was not shut, which was more effective than posting a note. Comparing light and sound, Mrs. A responded better to the flashing light, but she also seemed to follow the voice message as well. In addition, Mrs. A was seen asking her daughter to shut the window instead of shutting it herself. Conversely, of the 15 times Mrs. A shut the window, 5 of those times the system wasn't powered on, suggesting that the flashing lights and voice message conveyed the necessary information more strongly.

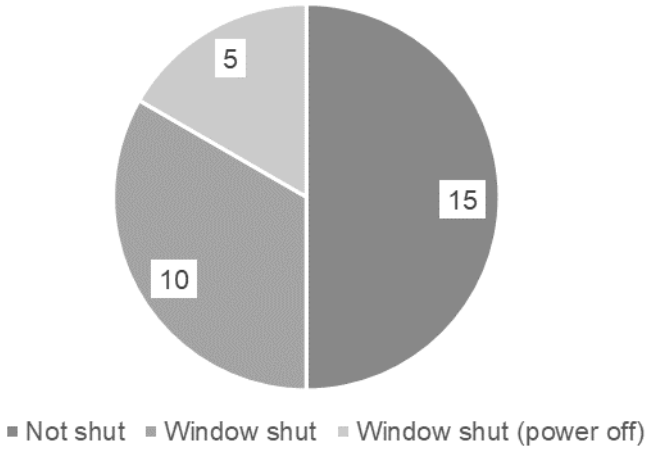


*Figure 4. Prototype system usage results.*

There were difficulties with the sensitivity of the human detecting sensor; when first installed, it sometimes detected incorrectly when the daughter was in her room, and sometimes mistakenly detected even when no one was in the room. During the experiment period, due to COVID-19, experimental staff were unable to visit the home directly, and thus it was necessary to adapt the work involved so that it could be performed by the daughter herself. Accordingly, regarding the former issue, it was assumed that she could make a cylinder by wrapping a C battery in cardboard, and, after testing cylinder heights in advance and confirming that the detection range could be altered as shown

in Figure 5 with a 3cm-high cylinder, we explained how to make and attach the cylinder to the daughter and improved detection errors (Figure 6). Regarding the latter issue, thinking that the system being shaken by the wind was causing detection errors, we had the daughter adjust the installation position, which improved detection errors. As a result, it was confirmed that the caregiving family members could successfully use the system on their own.

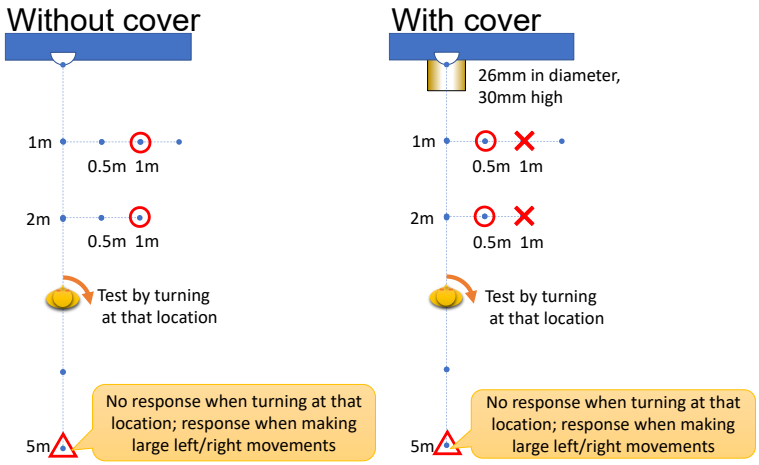


*Figure 5. Adjusting detection range using a cover.*

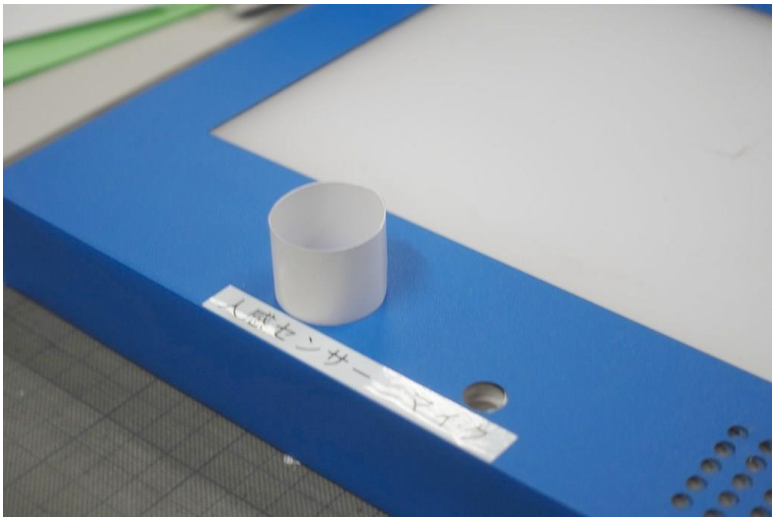

*Figure 6. Attachment of the cover.*

Regarding Mrs. A's window-closing behavior, the daughter stated, "I would say that rather than becoming used to the system's warnings and ignoring them, it seemed that my mother had emotional ups and downs throughout the day, and when she was very talkative and active, she tended to shut the window." In addition, in one case of shutting the window, Mrs. A posted a message herself on the board stating "I'm shutting the window" before shutting the window. In this case, it is conceivable that Mrs. A correctly understood the content of the prompt and chose not to comply with it.

As a result of the case of Mrs. A, it was found that the system had an effect. Conversely, as in the case where Mrs. A posted her own memo, it was suggested that there are also limits to the system's prompts. The system's prompts are such that they cannot force a specific action to be taken, respecting the decision-making of the subject. Consequently, for example in a situation where there were significant risks such as the management of potential sources of a fire, it would be desirable to

prepare a provision which would automatically extinguish the fire source in the event a prompt wasn't effective.

In addition, in this evaluation test, we had the daughter write the board's message and record the voice message and in turn achieved a result. However, in the introduction of this system, it is necessary to consider whether or not the system might be controlling a subject's behavior. Behavioral control is often used from perspective of caregivers; however, because of the possibility of reducing action taken by the subject, consideration should be given to the language used. In addition, praising someone for doing something can also help reinforce behaviors, and we believe research should also be put into ways of prompting which do this.

## CONCLUSION

In this research, under the concept of providing prompts to people with dementia, we proposed a whiteboard which conveys information using light and sound, confirming its effectiveness through its temporary installation in the home of an elderly person with dementia. As a result of verification at the home of one participant, the effectiveness and issues of the prototype system were confirmed. Going forward, we would like to investigate medium-to-long-term feedback and the addition of monitoring functions, such as adding a data log function to the sensor component.

## ACKNOWLEGEMENTS

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## NOTES

[1] "Annual Report on the Ageing Society FY 2021," *Cabinet Office, Government of Japan* (in Japanese), accessed January 30, 2022, https://www8.cao.go.jp/kourei/whitepaper/index-w.html.
[2] Kazuhisa Miwa and Hitoshi Terai, "Theoretical Investigation on Disuse Atrophy Resulting from Computer Support for Cognitive Tasks," in *Engineering Psychology and Cognitive Ergonomics*, ed. Don Harris (Springer, 2014), 244-254.
[3] Richard Fleming, John Zeisel and Kirsty Bennett, *World Alzheimer Report 2020: Design, Dignity, Dementia: Dementia-related design and built environment* (Alzheimer's Disease International, 2020), accessed January 30, 2022, https://www.alzint.org/resource/world-alzheimer-report-2020/.
[4] Lesley Palmer, Katie Wallace and Lynsey Hutchinson (eds.), *Architecture for dementia: Stirling Gold: 2008-2020* (University of Stirling, 2021).
[5] "Improving the Design of Housing to Assist People with Dementia," Dementia Services Development Centre (DSDC), University of Stirling, accessed January 30, 2022, https://www.housinglin.org.uk/_assets/Resources/Housing/OtherOrganisation/DSDC_dementia_design.pdf.
[6] Yusuke Mizuno, Shuko Ito, Satoru Yamazaki and Hideaki Katsumata, "Experimental Research on the Guidance Effect of Residents' Rooms and Restrooms Signs for the Elderly with Dementia," J. Archit. Plann., AIJ 87, no. 791 (2022): 1-11.
[7] Yusuke Mizuno, Shuko Ito, Satoru Yamazaki, and Hideaki Katsumata, "Consideration of Needs and Elements of Residents' Room Signs in Group Homes for the Elderly with Dementia," J. Archit. Plann., AIJ 84, no. 762 (2019): 1669-1679.
[8] Nicola Camp, Martin Lewis, Kirsty Hunter, Julie Johnston, Massimiliano Zecca, Alessandro Di Nuovo, and Daniele Magistro, "Technology Used to Recognize Activities of Daily Living in Community-Dwelling Older Adults," Int. J. Environ. Res. Public Health 18, 163 (2021): https://doi.org/10.3390/ijerph18010163.
[9] David Neal, Floor van den Berg, Caroline Planting, Teake Ettema, Karin Dijkstra, Evelyn Finnema, and Rose-Marie Dröes, "Can Use of Digital Technologies by People with Dementia Improve Self-Management and Social Participation? A Systematic Review of Effect Studies," J. Clin. Med. 10, 604 (2021): https://doi.org/10.3390/jcm10040604.
[10] Eleni Boumpa, Anargyros Gkogkidis, Ioanna Charalampou, Argyro Ntaliani, Athanasios Kakarountas, and Vasileios Kokkinos, "An Acoustic-Based Smart Home System for People Suffering from Dementia," Technologies 7, 29 (2019): https://doi.org/10.3390/technologies7010029.
[11] Kazue Noda, Jiro Sagara, Rumi Tanemura, Toru Nagao, Junko Hoshii, Tomoko Uchida, Osamu Nakata and Kousaku Sunagawa, "New Concept for Supporting the Elders Having Garbage Troubles," Innovation in Aging 1(Suppl 1) (2017): 230, doi: 10.1093/geroni/igx004.855.
[12] Jiro Sagara, Rumi Tanemura, Toru Nagao, Kazue Noda and Kiyohiro Omori, "Auto Cue System for the Person with Mild Cognitive Impairment," International Convention on Rehabilitation Engineering and Assistive Technology (i-CREATe 2019) (Canberra, Australia, August 26-29, 2019).
[13] Jiro Sagara, Rumi Tanemura, Toru Nagao, Kazue Noda and Kiyohiro Omori, "Some Design Proposals to Support Independent Life of the Elderlies with Mild Cognitive Impairments who Live Alone," Universal Design & Higher Education in Transformation Congress, Dublin Castle (2018): https://arrow.tudublin.ie/unides18pap/13.

## BIBLIOGRAPHY

Boumpa, Eleni, Anargyros Gkogkidis, Ioanna Charalampou, Argyro Ntaliani, Athanasios Kakarountas, and Vasileios Kokkinos. "An Acoustic-Based Smart Home System for People Suffering from Dementia." Technologies 7, 29 (2019): https://doi.org/10.3390/technologies7010029.

Cabinet Office, Government of Japan. "Annual Report on the Ageing Society FY 2021" (in Japanese). Accessed January 30, 2022. https://www8.cao.go.jp/kourei/whitepaper/index-w.html.

Camp, Nicola, Martin Lewis, Kirsty Hunter, Julie Johnston, Massimiliano Zecca, Alessandro Di Nuovo, and Daniele Magistro, "Technology Used to Recognize Activities of Daily Living in Community-Dwelling Older Adults," Int. J. Environ. Res. Public Health 18, 163 (2021): https://doi.org/10.3390/ijerph18010163.

Dementia Services Development Centre (DSDC), University of Stirling. "Improving the Design of Housing to Assist People with Dementia." Accessed January 30, 2022.

https://www.housinglin.org.uk/_assets/Resources/Housing/OtherOrganisation/DSDC_dementia_design.pdf.

Fleming, Richard, John Zeisel and Kirsty Bennett. *World Alzheimer Report 2020: Design, Dignity, Dementia: Dementia-related design and built environment*, Alzheimer's Disease International, 2020. Accessed January 30, 2022. https://www.alzint.org/resource/world-alzheimer-report-2020/.

Miwa, Kazuhisa, and Hitoshi Terai. "Theoretical Investigation on Disuse Atrophy Resulting from Computer Support for Cognitive Tasks." in *Engineering Psychology and Cognitive Ergonomics*, ed. Don Harris, 244-254. Springer, 2014.

Mizuno, Yusuke, Shuko Ito, Satoru Yamazaki and Hideaki Katsumata. "Experimental Research on the Guidance Effect of Residents' Rooms and Restrooms Signs for the Elderly with Dementia," J. Archit. Plann., AIJ 87, no. 791 (2022): 1-11.

Mizuno, Yusuke, Shuko Ito, Satoru Yamazaki and Hideaki Katsumata. "Consideration of Needs and Elements of Residents' Room Signs in Group Homes for the Elderly with Dementia," J. Archit. Plann., AIJ 84, no. 762 (2019): 1669-1679.

Neal, David, Floor van den Berg, Caroline Planting, Teake Ettema, Karin Dijkstra, Evelyn Finnema, and Rose-Marie Dröes. "Can Use of Digital Technologies by People with Dementia Improve Self-Management and Social Participation? A Systematic Review of Effect Studies." J. Clin. Med. 10, 604 (2021): https://doi.org/10.3390/jcm10040604.

Noda, Kazue, Jiro Sagara, Rumi Tanemura, Toru Nagao, Junko Hoshii, Tomoko Uchida, Osamu Nakata and Kousaku Sunagawa. "New Concept for Supporting the Elders Having Garbage Troubles." Innovation in Aging 1(Suppl 1) (2017): 230. doi: 10.1093/geroni/igx004.855.

Palmer, Lesley, Katie Wallace and Lynsey Hutchinson (eds.). *Architecture for dementia. Stirling Gold: 2008-2020*. University of Stirling, 2021.

Sagara, Jiro, Rumi Tanemura, Toru Nagao, Kazue Noda and Kiyohiro Omori. "Auto Cue System for the Person with Mild Cognitive Impairment." International Convention on Rehabilitation Engineering and Assistive Technology (i-CREATe 2019) (Canberra, Australia, August 26-29, 2019).

Sagara, Jiro, Rumi Tanemura, Toru Nagao, Kazue Noda and Kiyohiro Omori. "Some Design Proposals to Support Independent Life of the Elderlies with Mild Cognitive Impairments who Live Alone." Universal Design & Higher Education in Transformation Congress, Dublin Castle (2018): https://arrow.tudublin.ie/unides18pap/13.

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