

# Designing For Wellbeing: The Role of Architecture in Addressing Social Equity in Response to COVID-19.

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**ABSTRACT:** The spread of COVID-19 has dramatically shifted the nature of the relationship between people and their surrounding environment. The way people inhabit a space, interact with its surfaces, and the occupation density is now guided by sets of rules that aim at ensuring people's safety from the virus. Safety measures such as social distancing, working remotely, and self-quarantining are taken in order to slow the spread rate. Consequently, the design of the built environment is being retrofitted in response to the currently evolving situation.

However, as people's needs, abilities, and socio-economic circumstances differ, adaptation needs to be equitable and inclusive to all users. A response that doesn't have equity as a central consideration risks the wellbeing of those occupants that are the most vulnerable such as people of color, immigrants, the elderly, and other vulnerable population groups. The methodology acknowledges and addresses the lessons learned from past pandemics and public health issues such as cholera and the Spanish flu. The goal of this research is to ensure a safe, inclusive, and equitable environment in light of the pandemic. It aims to provide designers with a robust set of principles to guide the design process.

An investigation of the vulnerable user groups is conducted to identify their necessary needs. These findings are followed by a data classification phase to identify equitable post-pandemic design principles. These indicators lead to the formulation of a design toolkit for an equitable and inclusive response. Furthermore, spatial analysis is used to evaluate the design interventions and to systematically apply the toolkit. Visibility graph analysis, isovists, and justified accessibility graphs are generated to test the toolkit on floor plans and evaluate the design interventions and their impact on the social performance of spaces. The application of this proposal promotes a healthy and safe environment for the different groups of users.

**KEYWORDS:** Equitable design, post-pandemic architecture, wellness, public health, vulnerable populations, space syntax.

## INTRODUCTION

In addition to the historical, socio-cultural and economic factors, the design of the physical world we live in today is also a combination of design principles and laws that were implemented in response to past illnesses and epidemics. These events had an impact on the design of the urban, architectural, and interior environments. Early on in history, were implemented to provide a healthier environment. This resulted in wider streets and better there was a realization that spaces can be purposefully designed to assist in the prevention, containment, and treatment of infectious diseases (Chang 2020) At the end of the Middle Ages, building and urban codes infrastructure (Haley 2020), building materials were regulated by law after the Great Fire of London in 1666 (Woodrow 2020), and the great Chicago fire changed the codes in the United States. In the 20th century, architectural modernism was an emerging movement in response to the Spanish flu and earlier pandemics, such as cholera (Chang 2020). Modernist architects were designing clean, smooth, and ornament-free surfaces in order to limit the spread of infection (Chang 2020).

In Le Corbusier's Villa Savoye, he rejected spaces that normally collect moisture or dust. The villa stands on piloti, with no dank cellar, and the flat roof serves as another living space instead of an attic (Carr 2014). In the letters that the Savoye family were sending to Le Corbusier stating their design preferences, one could sense their focus on hygiene through their request of a sink near the entrance and the requests for running water in various spaces (Savoye and Delhomme 2020). Another prime example of the critical role of architects in public health is displayed in the response to Ebola in 2014, with the renovation of isolation units, the creation of innovative ventilation strategies, and the design of pathogen-resistant surfaces (Murphy 2020).

Since February 2020, the United States of America has recorded over 31.8 million confirmed cases of COVID-19. The whole world is learning more about this novel virus as the days go by, and safety measures such as social distancing, working remotely, and self-quarantining are taken in order to slow the spread rate. The center for Disease

control and prevention (CDC) provides a regularly updated set of guidelines and recommendations (*C. f. Prevention* 2021).

All this requires altering the physical surroundings, either to accommodate new functions or to facilitate a safe and healthy environment. It only makes sense to learn from the events that happened in the past and to build on this knowledge. However, in order to be able to reach an equitable and inclusive response, the design process should take a critical approach to identify and acknowledge the different needs of our communities today. The industrial community of New Lanark is an early example of a project that prioritized wellness and equity. This small 18th-century village set in a sublime Scottish landscape was where the philanthropist and Utopian idealist Robert Owen molded a model industrial community in the early 19th century (UNESCO 2001). Owen prioritized health and cleanliness and the education of children of the workers (Dowd 2020). He aimed to serve the workers and their families and provided them with spacious and well-designed housing. But although this project aimed to help the poor, it was criticized for not empowering them, a powerful figure was still needed to achieve positive social change (García 2016). An equitable design should dismantle systemic inequities fundamentally and challenge them, and that is the main goal for this research.

In Congo, single-patient transparent units emerged during the recent Ebola outbreak to isolate patients, protect health workers and to permit loved ones to visit without risking exposure. Healthcare workers were able to monitor vital signs from outside the units, and the mental wellness of the patients and their visitors was prioritized. Another recent response to Tuberculosis is a new hospital in Haiti. The facility has a garden and open spaces, lots of sunlight and air flow from different directions at all times. These recent responses provide opportunities to learn from public response and priorities in facing diseases.

## 1.0 IDENTIFYING VULNERABLE POPULATIONS

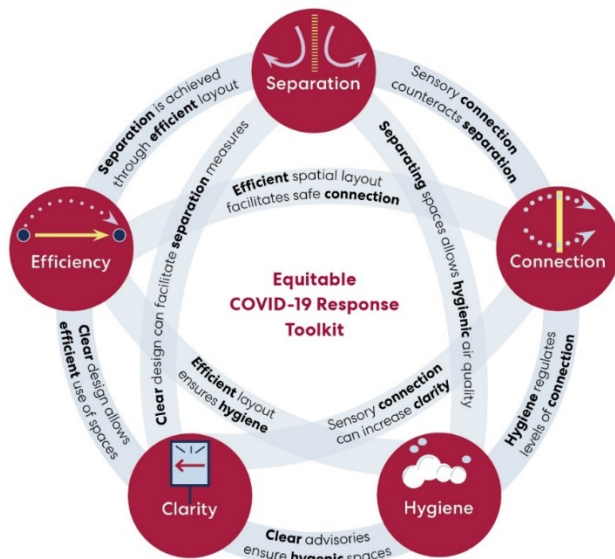
Data is showing that the pandemic is disproportionately affecting people from marginalized communities (Williams and Blanco 2020). CDC publishes reports that compare rate ratios of COVID cases, hospitalization, and death between different races and ethnicities (*C. f. Prevention* 2021). This disparity can be traced back to several social, economic, financial, and health related conditions. These conditions either facilitate or hinder a community's ability to take these safety measures. Given that the design of spaces, buildings and cities plays a vital role in public health (Luscombe 2020), it should also aim to eliminate disparities and to achieve equity. This can be achieved through the application of inclusive design principles that address the different needs of users. In order to be inclusive to different vulnerable population groups, and to be able to accommodate their different needs, these groups should be first identified. In addition to the general public health regulations that would serve all building users, this section aims to pinpoint critical design elements that serve vulnerable users.

Research shows that the level of risk of contracting the virus is different depending on gender. Cultural and social aspects play an important role in this. For instance, there is a global increase in the number of reports of domestic violence against women as a result of lockdown regulations (Mohan 2020). Women also comprise more than the majority of humanitarian workforce, which puts them in higher risk (Sharma , et al. 2020). With their role as mothers, and in many cases caregivers to vulnerable family members, they need hygienic building utilities that accommodate their needs as well as those of children and accompanying dependents. Examples include lactation rooms, family bathrooms, and socially distant waiting areas.

Additionally, certain communities are exposed to inequitable socio-economic conditions and political factors that causes their vulnerability. This includes people of color, immigrants, and LGBTQ + populations (Kline 2020). Pandemic response teams such as Health Cluster and partners aimed to protect, assist and advocate for refugees, internally displaced people, migrants and host communities for their vulnerability to the pandemic (*WHO 2020*)<sup>[66]</sup>. The use of inclusive language and clear visual representation of health advisories is critical to serving these groups. While many of them also face discrimination, providing inclusive restrooms, wellness rooms and lactation rooms will increase their chances of a more hygienic experience.

Many resources explored how the physical and mental state of users require different measures. Singh (2020) discussed how the different physical and sensory needs of users should be considered in the design of spaces and of the health advisories. 80% of people with disabilities in the world live below the poverty line and are the most negatively affected by the social and economic impact of the lockdown and social distancing measures (*Reliefweb* 2020). Choi et al. (2020) and Carnevalea and Hatak (2020) focused on the users' mental health and highlighted the importance of addressing this in such unprecedented times. This calls for an inclusive response that accounts for different physical and sensory abilities. This response includes social experiences as well, to minimize feelings of isolation and loneliness. Positive nudging would improve the general morale and decrease stress while following health advisories.

## 2.0 EQUITABLE RESPONSE TOOLKIT



Through a process of synthesizing the data about the vulnerable population groups, lessons from past pandemics, and equitable design elements, a set of design principles was created. Pre-COVID, these design principles were prioritized depending on the project type, budget or other factors. For instance, connected spaces and open floor plans were common in workplaces, and separation was applied for acoustical purposes or to separate different uses. The proposed toolkit prioritizes these principles depending in the user groups instead. Figure 1 illustrates the relationships between the five design principles. The vulnerable population groups share a set of challenges that increase the risk of them getting the virus. The table below lists these challenges and illustrates how the toolkit addresses each of them. Table 1 highlights the direct connections; however, the design principles overlap and correlate, and the challenges apply to more groups and more people at different levels.

**Figure 1** Equitable response toolkit. Source: by author.

	Immigrants	The elderly	People with underlying health conditions	LGBTQ+ community	Isolated employees	Frontline workers	Females	People of color
Mental wellness								
Caregiving								
Interpretation of health advisories								
Physical wellness								
Socio-cultural aspects								
Discrimination								
Necessary interaction								

**Table 1** Challenges facing vulnerable population groups and toolkit application. Source: by author.

In the following section, the principles will be defined, and examples of actionable items are provided to guide the design process.

### 2.1. Clarity

Clarity in building layout and health advisories can ensure a safer experience.

*Examples of actionable items:*

- Provide simple health advisories.
- Strategically locate stairs and elevators.
- Design clear entrances and exists.
- Ensure clarity of space layout and intuitive.

## 2.2. Efficiency

Efficiency and functionality should be prioritized above other commercial or entertainment purposes.

*Examples of actionable items:*

- Design short one-way circulation paths.
- Minimize or avoiding unnecessary decorative elements.
- Take inspiration from principles of modernism and minimalism.
- Design purposeful spaces and surfaces.

## 2.3. Separation

Separation aims at decreasing unnecessary interaction with people or with surfaces.

*Examples of actionable items:*

- Separate furniture in seating areas.
- Limit capacities of meeting areas and open floor plans.
- Include gender neutral and family bathrooms.
- Install a greater number of smaller elevators, rather than large ones.

## 2.4. Connection

Visual and sensory connection contribute to the mental wellness of users and to motivate them to follow the safety advisories.

*Examples of actionable items:*

- Increase opportunities for visual and auditory connection.
- Promote social relationships using open public spaces on site.
- Allow virtual connection systems when possible.

## 2.5. Hygiene

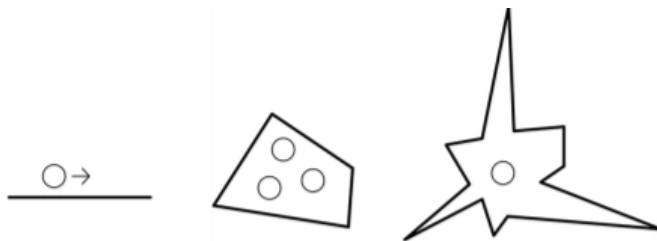
Material selection and mindful design interventions can facilitate cleanliness and contribute to a hygienic experience.

*Examples of actionable items:*

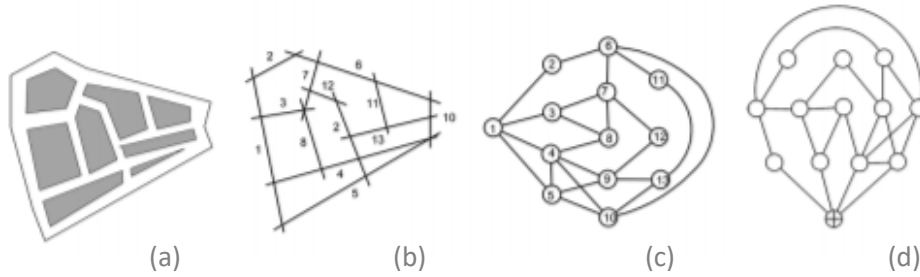
- Include sanitizing stations near entrances.
- Choose easy to clean materials.
- Avoid the design of spaces and corners that are hard to maintain and clean.
- Control temperature and humidity level.
- Allow natural ventilation.

## 3.0 SPATIAL ANALYSIS

Space Syntax theory provides a comprehensive and consistent framework for understanding spatial arrangements and their likely human effects, which we can term as social performance of buildings (Nourian, Rezvani and Sariyildiz n.d.). This method can be used to reveal the relationship between spaces and the social properties that necessitate or sustain these relations (Lee, Ostwald and Lee 2017). Figures 2 and 3 illustrate the basic representation methods used in space syntax.



**Figure 2** (left) a representation of the way people move, mostly along a line; (middle) convex space where users see each other and in which interactions take place; (right) the visibility field (Isovist), which has a different shape depending on where the observer is located (DETLAFF n.d.).

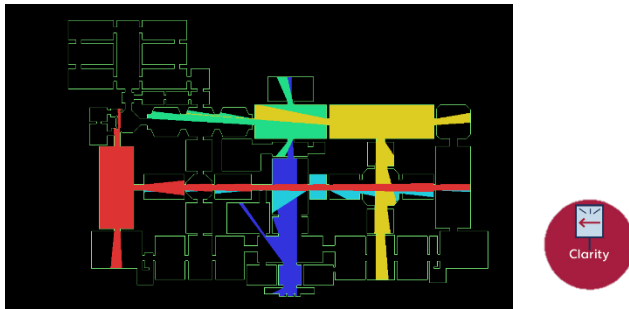


**Figure 3** (a) fictive urban system; (b) axial map; (c) connectivity graph; (d) justified graph (DETTLAFF n.d.).

### 3.1 Isovists

Isovists (figure 4) are a series of diagrams demonstrating the field of vision from different standpoints. The clarity of circulation paths, stairs, and elevators can be evaluated.

Toolkit application example: In a public building, visitors should be able to see the department/ spaces they need to go to directly without unnecessarily passing through more spaces.

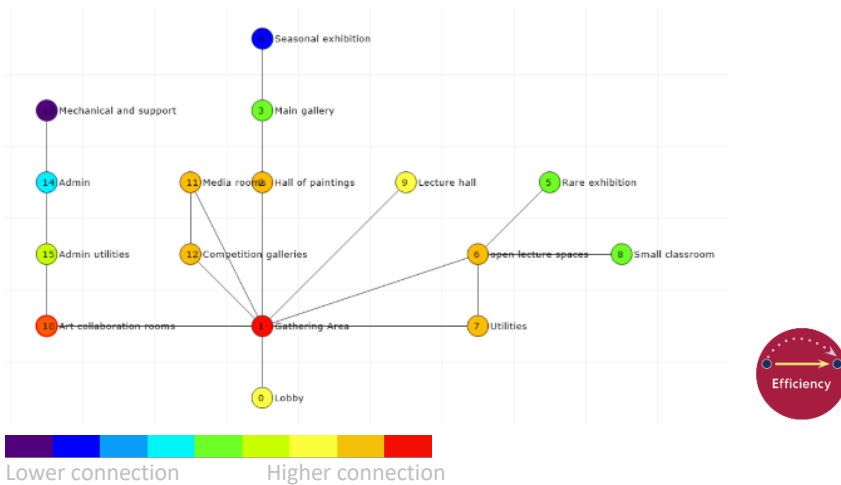


**Figure 4** Isovists from different standpoints. By author, software: DepthmapX

### 3.2 Justified accessibility graphs:

The circles in the diagram (nodes) represent spaces (figure 5). Red nodes are spaces that connect to many others. The efficiency of layout and circulation can be evaluated.

Toolkit application example: Red nodes are spaces that have high traffic. Such spaces should not include seating or waiting areas.



**Figure 5** Justified accessibility graphs. By author, software: Agraph.

### 3.3 Visibility graph analysis (VGA):

The VGA process (figure 6) maps various values (color coded from red for “very high” measures to dark blue for “very low” measures for representation) to each grid square. This figure shows that the four wings in have low connectivity values (dark blue), thereby becoming visually and socially isolated in the plan (Lee, Ostwald and Lee 2017).

This figure shows which areas of the floor plan are isolated and which ones are highly connected. Blue and red spaces indicate separation and connection respectively. Highly connected spaces should have high hygiene considerations such as sanitation stations.

Toolkit application example: Mental health should be prioritized for employees in isolated area.

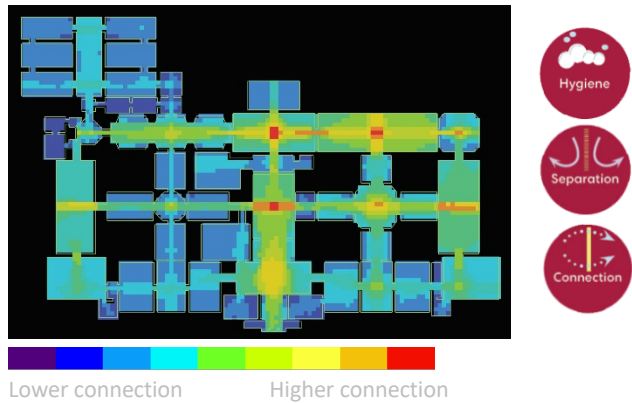


Figure 6 VGA. By author, software: DepthmapX

### CONCLUSION

The United Nations Network on Migration has issued a statement emphasizing that “COVID-19 does not discriminate, nor should our response” (*The department of global communications 2020*). Singapore was one of the countries that had to face the inequality within its society in order to contain the virus. The country’s second outbreak was centered in overcrowded areas inhabited by migrant workers, bringing the attention to the awful living conditions they endured (Bremmer 2020). At one point, 88 percent of the country’s cases were in these areas (Bremmer 2020). As a result, Singapore had to reintroduce stay-at-home orders and to close schools, making it the only country which experienced heavier social distancing and quarantine measures later into their Covid-19 journey (Soistmann 2020). Other pandemic diseases such as tuberculosis, HIV infection, and cholera are still in alarmingly high rates among some vulnerable populations who were marginalized in measures of diagnostics, pharmaceutical interventions, and public health solutions (Ivers and Walton 2020).

Through exploration of equitable design response, lessons from past pandemics, and the challenges facing vulnerable population groups, the toolkit was generated. It is composed from design interventions under the principles of separation, connection, clarity, efficiency and hygiene. The principles address the challenges and aim to create space that promote wellness to different groups of users. The design interventions are analyzed and evaluated through space syntax analysis. Isovists, VGA, and justified accessibility graphs are used to visually represent the toolkit and to test the impact of the design interventions. This research can have a positive impact on the design of healthcare facilities, workplaces, educational institutions, and different public facilities.

Future exploration of space syntax can help support and develop the toolkit. Currently, the spatial analysis is conducted in floor plans. Analyzing and studying building sections can provide deeper insight on the impact of the design interventions. Additionally, specialized facilities may require a focus on a specific population group, such as the elderly and caregivers in a care facility. An analysis of that specific typology is required to focus on the needs of these user groups. Finally, as our knowledge about the virus and its variants is increasing, the response should be altered and edited accordingly.

## ACKNOWLEDGEMENTS

This research was carried out during a research internship at Perkins&Will Minneapolis. I would like to thank Jennifer Christiaansen, Doug Bergert and Pratibha Chauhan for their contribution to this research and continuous guidance. Additionally, I gratefully thank my academic advisor Richard Graves and the director of the Master of Science in Research Practices program Malini Srivastava for their support and assistance throughout the duration of this project.

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