

Visibility intervention of circulation path configuration of Alun-alun Merdeka Malang City as Covid-19 resilient space

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ARTICLE INFO	ABSTRACT
<p><i>Article history:</i> Received June 19, 2022 Received in revised form July 04, 2022 Accepted July 13, 2022 Available online August 01, 2022</p> <p><i>Keywords:</i> Post-pandemic Public open space Simulation Space syntax</p> <p>*Corresponding author: Triska Prakasa Wikananda Department of Architectural Engineering and Planning, Faculty of Engineering, Universitas Gadjah Mada, Indonesia Email: triskaprakasa@mail.ugm.ac.id ORCID: https://orcid.org/0000-0002-2944-7135</p>	<p><i>With the lack of clarity on when the Covid-19 pandemic will end, there is a demand for a new design approach to the configuration of circulation paths in public open spaces. a design approach that can break up the crowd and form a space with a low-density pattern can be a new form of adaptation to new social arrangements and conditions after the pandemic. Therefore, it is necessary to conduct research through simulations related to the spatial aspects of the configuration of public open spaces and the activities in them, to see how the form of space and the elements supporting activities in accommodating activities, and predicting what forms of intervention are appropriate in accommodating activities in the new normal period. This study uses an experimental-simulative method through simulation of space syntax on the circulation path through the DephtmapX 0.50, to identify opportunities for regeneration of new designs to respond to the spatial potential of existing urban areas. It can be seen from the results of the space syntax simulation that with the addition of activity spaces and new circulation paths with strong symmetry, it can form a more even distribution of visitors to all parts of public open spaces.</i></p>

Introduction

Since Covid-19 was declared an international health disaster on March 11 2020 (WHO 2020), the Covid 19 Pandemic has demanded important changes in many areas. One of these changes is related to human mobility patterns and the activity environment (Venter et al. 2020; 2021). The pandemic has not only caused health problems in the global community, but has also caused widespread and profound impacts on social aspects throughout the World (Pavel and Burga 2020). In an effort to curb the COVID-19 pandemic, many countries have implemented various social restrictions. These measures vary between countries, but the most common are border and school closures, encouraging teleworking, social distancing, and mobility

restrictions, including lockdowns (Karnon 2020). Furthermore, to prevent the spread of COVID-19, several types of public spaces, including urban public open spaces, have been closed (Benzell, Collis, and Nicolaides 2020).

With this policy, access to and activities in public open spaces such as squares is restricted. The direct impact can be felt in public open spaces such as Alun-alun Merdeka Malang, where currently public open space is considered a space that is vulnerable to the spread of the COVID-19 virus. This restriction has an impact on the mental and physical health of the community (S. Liu and Wang 2021). Thus, accessibility to and within the urban public open space has emerged as one of the major problems in cities due to the pandemic (Honey-Rosés et al. 2020).



Urban public open spaces play a key role during the pandemic by providing ecosystem services relevant to health, recreation and social activities (Noszczyk et al. 2022). Urban public open spaces can improve human health and well-being and are gathering spaces for different socio-economic classes, reducing segregation and multiplying opportunities for psychological recovery (Liotta et al. 2020).

With many indoor recreational spaces closed due to COVID-19 restrictions, the role of public open spaces in improving population health is increasing (Geary et al. 2021). The magnitude of the negative impact of the emergence of COVID-19, as well as the important role of public open spaces, is shaping a trend that people need to fulfill their social needs in public open spaces regardless of any restrictions imposed in relation to the pandemic (Askarizad and He 2022). This

phenomenon can be seen in Malang City's Merdeka Square, where even with the activities restriction in outdoor spaces, the people of Malang City are still visit Malang City's Merdeka Square.

Thus, it is crucial to make urban areas more emergency-responsive, facing epidemics and other types of possible emergencies in the future (Megahed and Ghoneim 2020). The demand to adapt from the emergence of the Covid-19 pandemic phenomenon, requires us to new conditions, new demands, and new references or mindsets in the development of public open spaces. Architects and urban designers must design our built environment with the aim of stopping the spread of the virus by creating paradigms that can reduce the spread of the virus (Megahed and Ghoneim 2020).

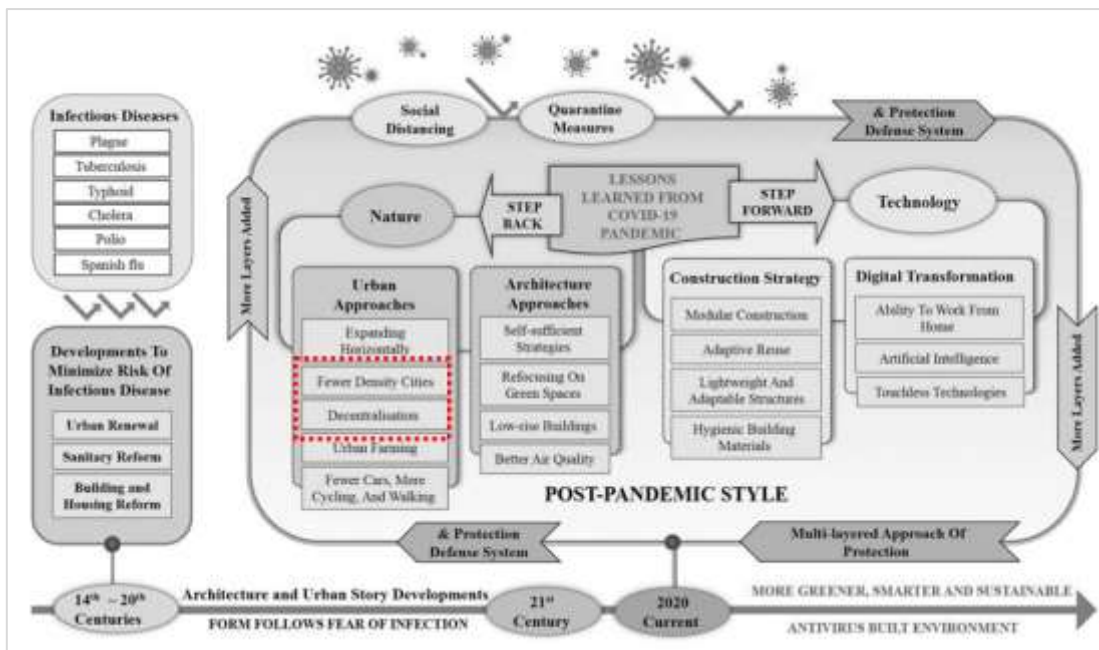


Figure 1. Visioning of public space approach in the post-pandemic period

Regarding the impact of social distancing, urban designers and architects can design according to the expansion of horizontal approaches with more open spaces available, which allows to prevent the spread of infections and diseases (L. Liu 2020). Since social distancing is an effort to reduce the spread of infection, some previous studies have attributed urban density to the rapid spread of infection (Megahed and Ghoneim 2020). Furthermore, from the diagram of the post-pandemic design

approach presented by Megahed and Ghoneim (2020) above, in an effort to adapt to post-pandemic conditions, urban space should be formed with a horizontal, decentralized and low-density space approach.

Furthermore, where the shape of the space configuration, will have an impact on visual permeability, is the main determinant of activities density (Carmona, de Magalhães, and Hammond 2008). configuration is the main generator (Hillier et al. 1993) in the formation of activity and

movement. So, to answer this phenomenon, there are several research questions as the focus of this research, including How is the relationship between activity patterns and the configuration of circulation paths in Alun-alun Merdeka Malang City? and how is the recommendation for a design approach to the configuration of circulation spaces and supporting elements of activities in Alun-alun Merdeka Malang City which is optimal as a public open space during post-pandemic era?

By identifying and understanding the relationship between activity patterns and the configuration of circulation space in Alun-alun Merdeka Malang City, it can estimate the form of recommendations for design approaches to the configuration of circulation space, to form public open space as an activity space that is safe from the threat of COVID-19 and similar viruses in the future.

Method

This research uses an experimental-simulative method through space syntax simulation on the configuration of the circulation path of Alun-alun

Merdeka on Malang City. The tool used is DephtmapX 0.50 software. The space syntax method also makes it possible to identify regeneration opportunities, and ensuring the new proposals respond to the spatial potential of existing urban areas (Czerkauer-Yamu and Voigt 2011; Putra 2021). Furthermore, the spatial organization of new design ideas can also be tested using space syntax analysis (van Nes and Yamu 2021).

The experimental-simulative method is carried out by testing several scenarios of public open space design recommendations into space syntax. space syntax simulation is carried out to find a circulation path configuration that can form a diffuse visitor activity pattern.

This method is used to see the relationship between the level of visibility of the circulation path configuration pattern and the activity pattern in the existing conditions, so that a strategy for a public open space design approach can be developed by adjusting it to the spatial approach in the post-pandemic period.

Result and discussion



Figure 2. Existing condition of Malang City's Merdeka Square

From the results of initial observations, there is a high tendency of the Malang community to do outdoor activities, it can be seen that the people of Malang continue to do activities in the open space of Merdeka Square, Malang City amid pandemic conditions. There is a tendency for the distribution pattern of activities to be more centralized at several points. (see figure 2) This is in line with (Megahed and Ghoneim 2020) the configuration of circulation paths that form patterns of activity

with a tendency to center at a point, becoming less suitable in the post-COVID-19 pandemic period. Thus, the condition of the existing circulation space configuration that forms a centralized pattern of activity distribution is less than optimal with its context in the post-pandemic period. Therefore, as an adaptation measure to this situation, the circulation path in the square should be able to form a more evenly distributed pattern of activity (decentralized).

1. Design recommendation

To form an open space that can break up the crowd in Malang City's Merdeka Square, as an effort to adapt activity patterns in post-pandemic public open spaces, design interventions are carried out on the configuration of circulation paths in the aspects of permeability and legibility. Furthermore, the effect on the distribution of activities formed in it through space syntax is

simulated. With the presence of legibility of an access or high activity space can create clarity of movement space that can direct visitors, and the existence of a high degree of ease of access (permeability) can create movement options for visitors (Bentley 1985). To increase the degree of permeability and legibility, interventions can be made by adding new circulation paths and adding new activity spaces.



Figure 3. Design recommendation scenario

To find a circulation path configuration design that can break up the density of visitor activities, two design recommendation scenarios are made with different approaches, which will be simulated through space syntax. In the first design scenario, only the addition of activity space is made at several circulation meeting nodes. In the second design scenario, to the addition of new activity spaces, a circular circulation path was also added followed by the addition of access points on all sides of the square (see figure 3).

Furthermore, in the aspect of legibility, space optimization is carried out by maintaining the readability of the space by maintaining the clarity of the landmark elements in the middle through the level of scale of the space. From the two design recommendation scenarios, it is then simulated through space syntax, to estimate the configuration pattern of the circulation path that can accommodate post-pandemic activities.

2. Simulation based on space syntax

a. Visibility graph analysis

To determine the effect of the visibility level of the intervention form on the configuration of the circulation space of Alun-alun Merdeka Malang City on the distribution pattern of visitors formed in it, space syntax simulation is carried out

on the parameters of visibility graph analysis and agent-based analysis.

From the results of the visibility graph analysis simulation, it can be seen that there is a tendency that by intervening in the configuration of the circulation path through the addition of activity nodes and circulation paths, where new activity nodes and circulation paths are added to the configuration of circulation paths with symmetrical balance, will form a more even distribution pattern of visibility levels, with the dominance of high visibility levels in the central area and the outer area of Merdeka Square on Malang City.

As seen in figure 4, there is a trend in the level of visibility in each circulation path configuration. In the existing condition, there is a dominance of high visibility levels in the center and the area in the south. Furthermore, in the first design recommendation scenario, despite the addition of nodes as activity spaces, the dominance of high visibility levels in the south still occurs. With the addition of nodes as activity spaces and the addition of circulation paths at the edges in the second design recommendation scenario, the pattern of visibility levels is more evenly distributed throughout the square space.

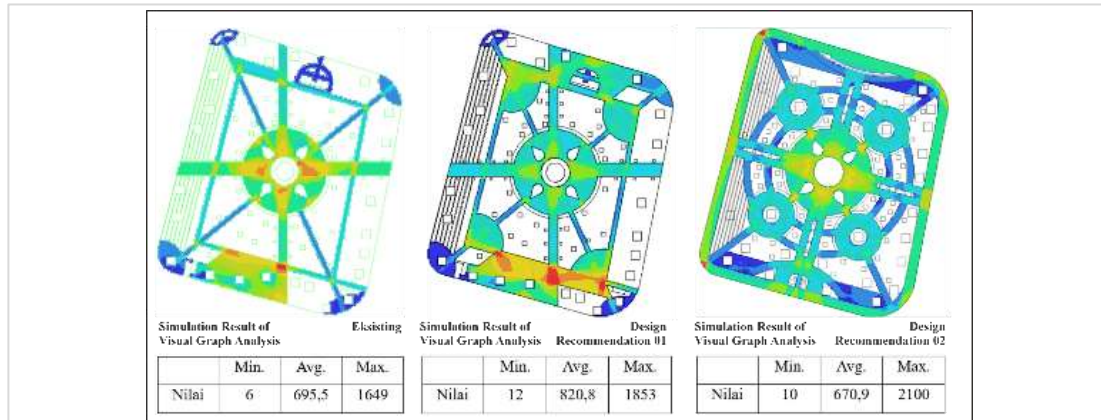


Figure 4. Visibility graph analysis comparison

b. Agent based analysis

From the simulation results of the visibility level formed in the three circulation path configurations, different visitor movement distribution patterns are formed. With the design intervention in the form of design recommendations, there is a decrease in visitor density in the southern part. The biggest decrease in frequency is seen in the second design recommendation, the tendency of activity

distribution patterns with an even concentration in the open space of the square (see figure 5).

In the existing condition circulation path configuration and design recommendation scenario one, there is still a tendency for a dense level of visitor distribution in the southern part. Furthermore, in the design recommendation scenario two, the density of visitor movement has been divided into all parts of the square.

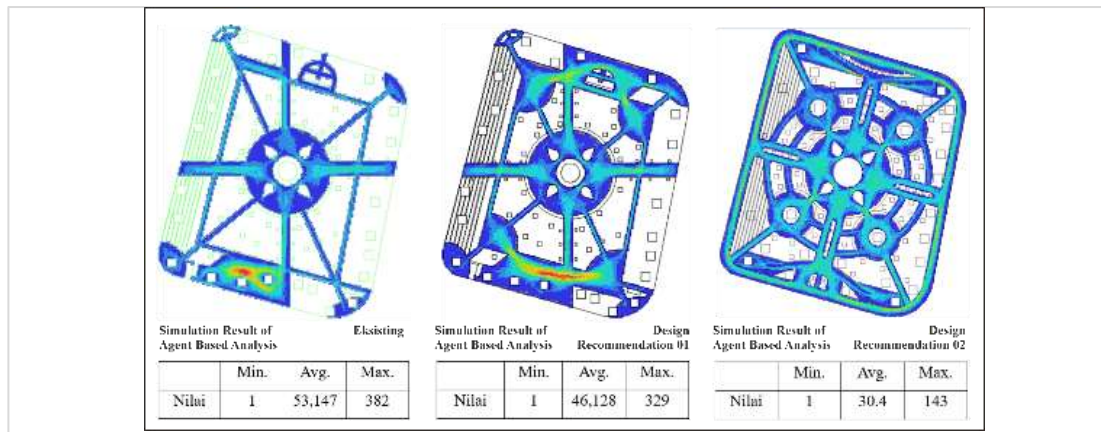


Figure 5. Agent based analysis comparison

3. Discussion

The main problem with public open spaces in the post-pandemic period is the need to balance the need for outdoor activities while maintaining health protocols such as social distancing. Many studies have validated that the continued trend of this phenomenon will lead to long-term negative impacts such as the emergence of isolation, loneliness, depression, etc. (Askarizad and He 2022). One form of adaptation of public open

space is by intervening in the configuration of the open space itself. Arrangement of space affects how we use it and how we connect it together (El-Darwish 2022). With the ease of access to and within the public open spaces can optimize the role of public open spaces in shading post-pandemic activities. By controlling the hierarchy of paths and spaces, it will regulate the direction of movement of activity actors (Hanan 2013).

To see in more clearly how the level of visibility affects visitor movement patterns, the results of the simulation are presented diagrammatically in figure 6. The high level of visibility in a configuration of public open space circulation paths, will form a movement that spreads throughout the square space (see figure 6)

furthermore, an alternative form of curvilinear and centralized nodes would fulfill several visual aspects, including connectivity and increased integration, it could also encourage social activities to spread over a larger portion of the park space (Mahmoud and Omar 2015).

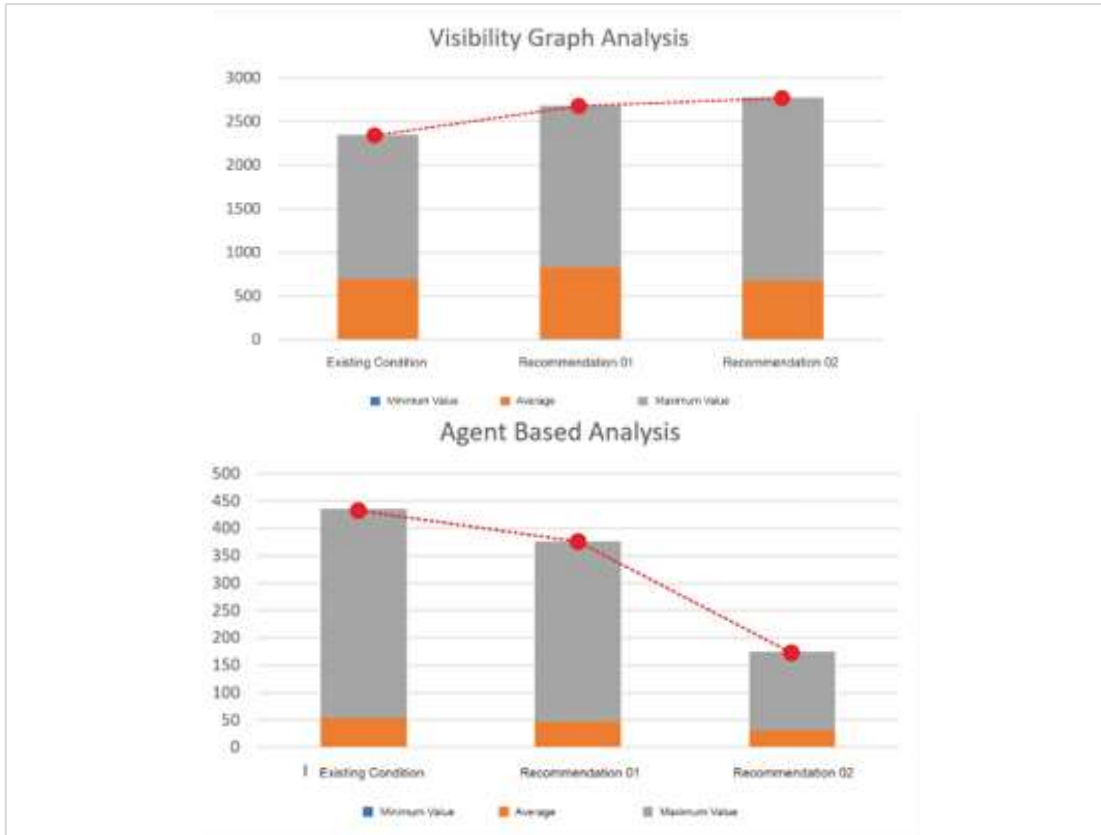


Figure 6. Comparison diagram of simulation results

From this tendency, it can be concluded that the intervention of visibility aspects on the configuration of the circulation path, through the addition of circulation paths and adding an activity space with a symmetrical balance, which is spread across all parts of the square space. By increasing the degree of legibility and permeability of the circulation path, can create a decentralized distribution of activities. It can be seen from the results of the space syntax simulation that by introducing new activity space options by adding activity nodes and circular pathway access, it can encourage activity distribution patterns with a more even frequency throughout the public open space. Where in further application, it can be supported by the

configuration of activity support elements that have an even distribution of diversity of functions with the support of flexible space functions.

Conclusion

From the simulation results through space syntax and observations, it can be seen that the visibility level of the circulation space configuration in Merdeka Square on Malang City has a direct influence on the pattern of activity distribution formed in it. So, to form an activity space with a more evenly distributed visitor pattern in Merdeka Square of Malang City in its adjustment to post-pandemic conditions, design interventions can be

carried out in the spatial aspect in the form of a circulation paths design configuration.

Through visibility intervention by modifying the configuration of circulation paths in the aspects of Permeability and Legibility, it can increase the choice of movement space for visitors. It can be seen from the results of the space syntax simulation that with the addition of activity space and new circulation paths with strong symmetry, as in the second design scenario, it can form a more even distribution pattern of visitors to all parts of the space at Merdeka Square Malang City. The configuration of the circulation path in the second design recommendation provides an alternative space for activities in public open spaces that can accommodate the needs of urban communities to do activities in the outdoor environment during the post-pandemic period.

Due to the difficulty of its application, the first scenario design recommendation is intended as a short-term design adjustment, while the second scenario design recommendation is intended as a long-term design adjustment of the square's open space.

In this research, from the findings on the simulation of the configuration of circulation paths in Alun-alun Merdeka Malang City, it has not touched on deeper aspects, only limited to the natural movement of the visitor influenced by the form of space configuration offered in public open spaces.

The findings of this research can be used as a reference for other open spaces that have similar cases to Alun-alun Merdeka Malang City where visitor activity patterns are influenced by the configuration of the circulation space and the distribution of supporting elements for activities in it. In determining the design approach for post-pandemic public open spaces, further research is still needed regarding supporting elements and activity patterns in the post-pandemic socio-spatial context.

References

Askarizad, Reza, and Jinliao He. 2022. 'Post-Pandemic Urban Design: The Equilibrium between Social Distancing and Social Interactions within the Built Environment'.

- Cities* 124 (May): 103618. <https://doi.org/10.1016/j.cities.2022.103618>.
- Bentley, Ian. 1985. *Responsive Environments: A Manual for Designers*. London: Architectural Press.
- Benzell, Seth G., Avinash Collis, and Christos Nicolaidis. 2020. 'Rationing Social Contact during the COVID-19 Pandemic: Transmission Risk and Social Benefits of US Locations'. *Proceedings of the National Academy of Sciences* 117 (26): 14642–44. <https://doi.org/10.1073/pnas.2008025117>.
- Carmona, Matthew, Claudio de Magalhães, and Leo Hammond. 2008. *Public Space: The Management Dimension*. *Public Space: The Management Dimension*. <https://doi.org/10.4324/9780203927229>.
- Czerkauer-Yamu, Claudia, and Andreas Voigt. 2011. 'Strategic Planning and Design with Space Syntax'. In *Proceedings of the International Conference on Education and Research in Computer Aided Architectural Design in Europe*, 125–33. Europe. <https://doi.org/10.52842/conf.ecaade.2011.125>.
- El-Darwish, Ingy Ibrahim. 2022. 'Enhancing Outdoor Campus Design by Utilizing Space Syntax Theory for Social Interaction Locations'. *Ain Shams Engineering Journal* 13 (1): 101524. <https://doi.org/10.1016/j.asej.2021.06.010>.
- Geary, Rebecca S, Benedict Wheeler, Rebecca Lovell, Ruth Jepson, Ruth Hunter, and Sarah Rodgers. 2021. 'A Call to Action: Improving Urban Green Spaces to Reduce Health Inequalities Exacerbated by COVID-19'. *Preventive Medicine* 145 (April): 106425. <https://doi.org/10.1016/j.ypmed.2021.106425>.
- Hanan, Himasari. 2013. 'Open Space as Meaningful Place for Students in ITB Campus'. *Procedia - Social and Behavioral Sciences* 85 (September): 308–17. <https://doi.org/10.1016/j.sbspro.2013.08.361>.
- Hillier, B, A Penn, J Hanson, T Grajewski, and J Xu. 1993. 'Natural Movement: Or, Configuration and Attraction in Urban Pedestrian Movement'. *Environment and Planning B: Planning and Design* 20 (1): 29–66. <https://doi.org/10.1068/b200029>.
- Honey-Rosés, Jordi, Isabelle Anguelovski, Vincent K. Chireh, Carolyn Daher, Cecil Konijnendijk van den Bosch, Jill S. Litt, Vrushti Mawani, et al. 2020. 'The Impact of

- COVID-19 on Public Space: An Early Review of the Emerging Questions – Design, Perceptions and Inequities’. *Cities & Health* 5 (sup1): S263–79.
<https://doi.org/10.1080/23748834.2020.1780074>.
- Karnon, Jonathan. 2020. ‘A Simple Decision Analysis of a Mandatory Lockdown Response to the COVID-19 Pandemic’. *Applied Health Economics and Health Policy* 18 (3): 329–31.
<https://doi.org/10.1007/s40258-020-00581-w>.
- Liotta, Charlotte, Yann Kervinio, Harold Levrel, and Léa Tardieu. 2020. ‘Planning for Environmental Justice - Reducing Well-Being Inequalities through Urban Greening’. *Environmental Science & Policy* 112 (October): 47–60.
<https://doi.org/10.1016/j.envsci.2020.03.017>.
- Liu, Lu. 2020. ‘Emerging Study on the Transmission of the Novel Coronavirus (COVID-19) from Urban Perspective: Evidence from China’. *Cities* 103 (August): 102759.
<https://doi.org/10.1016/j.cities.2020.102759>.
- Liu, Shu, and Xinhao Wang. 2021. ‘Reexamine the Value of Urban Pocket Parks under the Impact of the COVID-19’. *Urban Forestry & Urban Greening* 64 (September): 127294.
<https://doi.org/10.1016/j.ufug.2021.127294>.
- Mahmoud, Ayman Hassaan, and Reham H. Omar. 2015. ‘Planting Design for Urban Parks: Space Syntax as a Landscape Design Assessment Tool’. *Frontiers of Architectural Research* 4 (1): 35–45.
<https://doi.org/10.1016/j.foar.2014.09.001>.
- Megahed, Naglaa A., and Ehab M. Ghoneim. 2020. ‘Antivirus-Built Environment: Lessons Learned from Covid-19 Pandemic’. *Sustainable Cities and Society* 61 (October): 102350.
<https://doi.org/10.1016/j.scs.2020.102350>.
- Nes, Akkelies van, and Claudia Yamu. 2021. *Introduction to Space Syntax in Urban Studies*. Cham: Springer International Publishing. <https://doi.org/10.1007/978-3-030-59140-3>.
- Noszczyk, Tomasz, Julia Gorzelany, Anita Kukulska-Kozielek, and Józef Hernik. 2022. ‘The Impact of the COVID-19 Pandemic on the Importance of Urban Green Spaces to the Public’. *Land Use Policy* 113 (February): 105925.
<https://doi.org/10.1016/j.landusepol.2021.105925>.
- Pavel, Ciprian, and Ruben Burga. 2020. ‘Opportunities for Information and Communication Technology Development in Remote Northern Ontario Indigenous Communities in Spite of COVID-19 Physical Restrictions’. *Journal of Indigenous Social Development* 9 (3): 1–15.
- Putra, Gierlang Bhakti. 2021. ‘Space Syntax Analysis of Urban Housing Transformation in Indonesia’. *ARTEKS: Jurnal Teknik Arsitektur* 6 (3): 415–24.
<https://doi.org/10.30822/arteks.v6i3.944>.
- Venter, Zander S., David N. Barton, Vegard Gundersen, Helene Figari, and Megan S. Nowell. 2021. ‘Back to Nature: Norwegians Sustain Increased Recreational Use of Urban Green Space Months after the COVID-19 Outbreak’. *Landscape and Urban Planning* 214 (October): 104175.
<https://doi.org/10.1016/j.landurbplan.2021.104175>.
- Venter, Zander S., David N. Barton, Vegard Gundersen, Helene Figari, and Megan S. Nowell. 2020. ‘Urban Nature in a Time of Crisis: Recreational Use of Green Space Increases during the COVID-19 Outbreak in Oslo, Norway’. *Environmental Research Letters* 15 (10): 104075.
<https://doi.org/10.1088/1748-9326/abb396>.
- WHO. 2020. ‘Coronavirus Disease (COVID-19) Pandemic’. Geneva: World Health Organization. 2020.
<https://www.who.int/emergencies/diseases/novel-coronavirus-2019>.

Author(s) contribution

Triska Prakasa Wikananda contribute to the research concepts preparation and literature reviews, data analysis, of article drafts preparation and validation.

Nedyomukti Imam Syafii contributed to the research concepts preparation, methodologies, investigations, data analysis, visualization, articles drafting and revisions.