

The quality of biophilic elements in child-friendly open space A case study of Merjosari Park, Malang City

Agung Murti Nugroho

Department of Architecture, Faculty of Engineering, Universitas Brawijaya
Jl. MT Haryono, no. 167, Malang, Indonesia



ARTICLE INFO	ABSTRACT
<p><i>Article history:</i> Received June 29, 2021 Received in revised form July 09, 2021 Accepted July 30, 2021 Available online December 01, 2021</p> <p><i>Keywords:</i> Biophilic elements Child-friendly open space Criteria Development Perception</p> <p>Corresponding author: Agung Murti Nugroho Department of Architecture, Faculty of Engineering, Universitas Brawijaya, Indonesia Email: agungmurti@ub.ac.id</p>	<p><i>There are many city parks currently used as public spaces and children's play facilities in Indonesia that do not meet the criteria for child-friendly open spaces. It is, however, important to note that biophilic elements are the natural environment components determining the quality of city parks. Therefore, this research was conducted to evaluate the criteria, perceptions, and development of biophilic elements in a child-friendly open space using Merjosari park in Malang which is one of those developed to achieve a child-friendly city as the case study. The biophilic elements criteria were determined using the Analysis Hierarchy Process (AHP) method while the perception of elements used the Importance Performance Analysis (IPA) method. First, the results showed the main criterion for the biophilic element according to experts is well-being while the highest sub-criterion is a safe space. Second, the seating element was found to be the visitors' perception of quality based on the highest level of suitability while the garden element has the highest service performance and safe space had the highest level of importance. Third, playing equipment was recommended to be prioritized in the development of biophilic elements quality based on its high value in the IPA analysis. Finally, safe space was discovered to be the most important biophilic element of child-friendly open space at Merjosari Park, Malang City according to expert criteria and visitors' perception.</i></p>

Introduction

City open spaces including the green and public spaces are required to be optimal (Liem and Lake 2018; Hasibuan et al. 2021). Meanwhile, new housing being developed in big cities in Indonesia is observed not to make provision for public space which is usually used as the vehicle for social interaction, especially for children (Tantarto and Hertoery 2020). This limits the open space for children to move, play and learn to socialize. Therefore, city parks have become the place for children to learn independently, love the natural environment, and develop strong social ties. This

is the reason its design needs to be safe and in harmony with the natural environment.

Biophilic design is the effort usually implemented to increase positive interactions and relationships between humans and nature in a built environment (Bahauddin, Prihantmanti, and Ong 2021). The term "biophilic" is a Greek word which means love of life and its elements influence the natural aspects while the bionic elements are focused on the design process. The architecture associated with the biophilic elements is directed towards minimizing the negative impact of the increasing urban temperatures by providing comfort and healthy

living for city-dwellers through the application of natural and green elements in open spaces.

Several studies have been conducted on biophilic elements in the urban environment in the last five years, especially on the aspects of the natural environment and green elements. Those focused on the natural environment include the city's microclimate, flora and fauna, and design elements (Ling and Chiang 2018; Kambo, Drogemuller, and Yarlagadda 2019; Kuldna, Poltimäe, and Tuhkanen 2020; Hwang and Roscoe 2017). Meanwhile, those associated with the green aspect consist of elements of green space, vertical gardens, and garden types (McCracken, Allen, and Gow 2016; Lotfi et al. 2020; Elsadek et al. 2019).

The influence of biophilic elements such as plants and natural landscapes on emotions, perceptions, and health behaviors was also studied by Lee (2019), Yin et al. (2018), and Lotfi et al. (2020). Meanwhile, natural elements were found to have the ability to reduce stress levels through natural forms, landscapes, and other strategies to imitate nature (Yin et al. 2018; van den Bosch and Ode Sang 2017). They were also discovered to have the ability to increase well-being through natural elements, plants, and connection with nature (Abdelaal 2019; Mangone et al. 2017; Van den Berg, Joye, and Koole 2016; Chen et al. 2019). Moreover, green elements also affect people's perceptions and expectations through the aspects of governance and level of naturalness (Fisher et al. 2017; Kuldna, Poltimäe, and Tuhkanen 2020; Tsantopoulos et al. 2018; Meidenbauer et al. 2019). They were also reported to have an impact on the well-being of the community according to the type of plant used (McCracken, Allen, and Gow 2016; Hwang and Roscoe 2017).

The biophilic elements in public open spaces such as city parks also affect the quality of children's playrooms. It was reported that the criteria for child-friendly open spaces include distance, well-being, entrance, roadway, marker, seat, fence, game equipment, supporting facilities, trees and plants, parks and gardens as well as sand and water games (Parsons 2011). These thirteen criteria, however, contain biophilic elements. First, sub-criteria for the location aspect include feeling happy, affordable walking distance (Kuldna, Poltimäe, and Tuhkanen 2020), local character, and visibility from all directions. Second, the well-being aspect includes health improvement, welfare, independence, and child

safety. Third, the entrance aspect includes the social meeting nodes, proximity to transportation facilities (Fisher et al. 2017), and visual markers. Fourth, the roadway aspect includes a variety of activities (Ling and Chiang 2018) and alternative explorations. Fifth, the markers aspect includes easy understandability by everyone and the availability of information on sustainable natural environments (Ling and Chiang 2018). Sixth, the seating aspect includes encouragement of child interaction and availability (Lee 2019). Seventh, the fence aspect includes the provision of security and supporting activities (Jamshidi, Parker, and Hashemi 2020). Eighth, play equipment sub-criteria include motor development and social interaction (Elsadek et al. 2019). Ninth, supporting facilities sub-criteria include clean atmosphere and aesthetic value (Kambo, Drogemuller, and Yarlagadda 2019). Tenth, trees and plants sub-criteria include increased curiosity, imagination, and being harmless (Lee 2019). Eleventh, the parks and gardens aspect include adding fine motor and sensory skills as well as children's health (McCracken, Allen, and Gow 2016). Twelfth, sand games sub-criteria include several creative and interactive game activities (Mangone et al. 2017). Finally, water games sub-criteria include multisensory characters and cleanliness. These thirteen criteria were used as the basis to evaluate the quality of biophilic elements in child-friendly open spaces, especially the city parks.

City parks are currently being increasingly developed in several cities of Indonesia with one observed to be located in Malang city. This is intended to provide quality basic services and fulfilling children's basic rights. It is also observed to be part of the efforts of the Malang City Government to always support the child-friendly city program (KLA) through the revitalization of city parks as indicated in Trunojoyo, Merjosari, Kunang-kunang, Slamet, Malabar City Forest, Ijen, and others. There is, however, the absence of a quality evaluation of the existing city park services especially through the use of the criteria for biophilic elements in child-friendly open spaces.

Merjosari Park, as one of the child-friendly park development programs in Malang City, has an important position in ensuring the availability of public open spaces in the city. It is located close to several educational facilities, residential neighborhoods, and trade facilities and this makes it a node for different activities in the area,

especially children. The Park is also an early example of the biophilic design application as indicated by the existence of different games and the use of natural elements in suburban areas.

Child-friendly city parks can be developed using several types of biophilic designs such as active, passive, and mixed parks. For example, Trunojoyo Park is an active park, Malabar City Forest is a passive park while Merjosari Park is a mixed park which is opened to all ages including children, adolescents, and adults, and also contains elements of a more complete biophilic design. There are, however, limited studies on the quality of the services delivered in this park, thereby, leading to its selection for this current research.

The research problem formulated was “what is the quality of biophilic elements in child-friendly open spaces in Merjosari Park, Malang City?” and the purpose was to evaluate the criteria, perception, and development of biophilic elements in child-friendly open spaces in city parks using AHP and IPA techniques. The findings are expected to increase the understanding of biophilic elements in designing child-friendly open spaces in city parks. This was based on the assumption that biophilic architecture is the main factor in shaping the quality of child-friendly open spaces through its green and natural elements. Moreover, the novelty of this study is that the relationship between the quality of biophilic elements and child-friendly open spaces especially in city park objects is rarely examined. Therefore, the quality was assessed by determining the criteria, perceived level of suitability, performance, and importance as well as the development proposals prepared by experts and the user community.

Method

Quantitative techniques and descriptive methods were used in this research to assess the criteria for the biophilic elements. This involves using the AHP to evaluate the child-friendly park based on the opinion of experts while the perception of the visitors was measure using the IPA technique. Recommendations for development were later made based on the results of these two methods.

AHP is one of the most popular Multi-Criteria Dimensional Method (MCDM) usually used in making decisions from several available choices. This technique helps in making decisions based on lower criteria based on the individual performance of each criterion and sub-criterion towards achieving certain goals (Purnomo, Sihwi, and Anggrainingsih 2013).

The AHP and IPA questionnaires were designed to be focused on biophilic elements in child-friendly open spaces using city parks as the case study. Moreover, the criteria were grouped into four basic aspects which include play value [K1], well-being [K2], accessibility [K3], and design integration [K4]. Meanwhile, each criterion has the same sub-criteria which are the distance from the road (A), safe space (B), entrance (C), roadway (D), marker (E), seat (F), fence (G), play equipment (H), supporting facilities (I), trees and plants (J), gardens (K), sand game (L), and water games (M). The AHP technique was, however, divided into three aspects and these include game elements, biophilic design considerations, and child developmental stage.

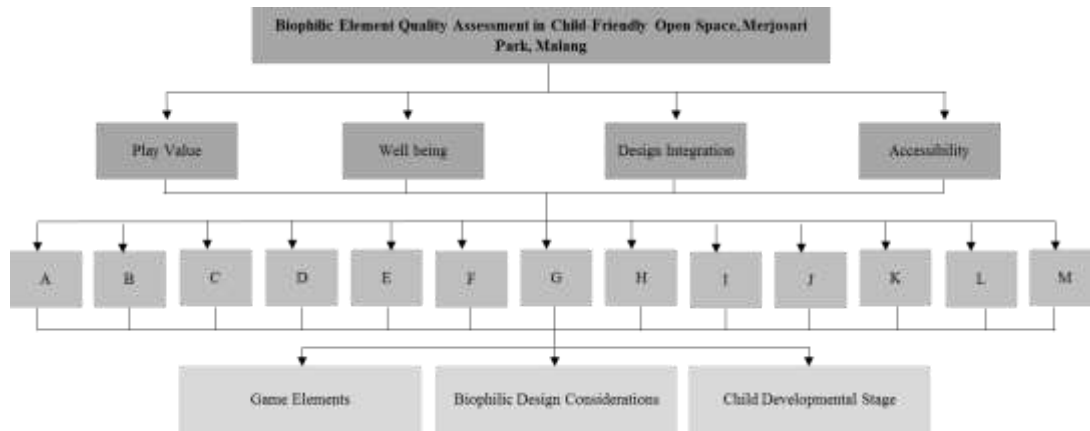


Figure 1. AHP diagram of biophilic element quality assessment in child-friendly open space

The experts used in the AHP method were selected based on experience and expertise in the development of public open spaces in Malang City and these led to the selection of five respondents with each representing child development practitioners, academics, architects, landscape architects, and policymakers.

The IPA analysis was used to evaluate the level of importance and service performance based on the perception of the visitors. This involved using all the users of Merjosari Park as present at the time of data collection as the research population. The data was collected for 14 days between 12-26 July 2018 which was divided into 4 weekends and 10 weekdays. Moreover, the sample size was determined using the Sample Linear Time Function formula which is based on an estimated time constraint. Therefore, the minimum number of visitors to be used as the sample in this study was determined as follows:

$$n = \frac{T - t_0}{t_1} = \frac{336 - 84}{7} = \frac{252}{7} = 36 \text{ people}$$

Where,

n = number of selected samples

T= research time (14 days x 24 hours = 336 hours)

t0= daily time (14 days x 6 hours/day = 84 hours)

t1= time for each sampling (30 minutes/day x 14 days = 7 hours)

A total of 39 respondents was, therefore, used in this research. Moreover, the main stage in the IPA method is the level of conformity which is usually obtained by dividing the value of performance with the value of importance such that a result close to 100.00% indicates the level

of conformity between the performance of park managers and visitors' interests is getting better. Meanwhile, when the value exceeds 100.00%, it means the visitors are satisfied. Furthermore, the limit of the Cartesian diagram in visualizing scientific analysis results was determined using the average of all the attributes of the level of importance (Y) and performance (X) of the respondent.

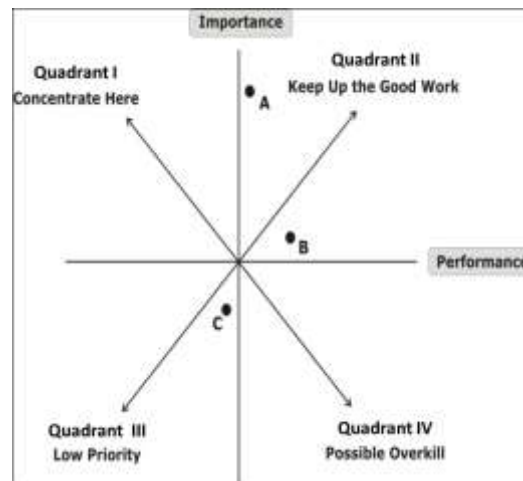


Figure 2. IPA quadrant as an assessment tool
 Source: (De Jesus Henriques Silva and Fernandes 2011)

The object of this research is a child-friendly park in Malang City which is managed by the city government through the Parks Service. It has a total area of 29,012 square meters bordered on the north and south by residences, to the east by a trade area, and to the west by a green open space as indicated in figure 3.



Figure 3. Location of Merjosari Park in Malang City

Result and discussion

Merjosari Park is one of the child-friendly parks developed in Malang City and is observed to be located on the outskirts unlike the other city parks as shown in figure 4.

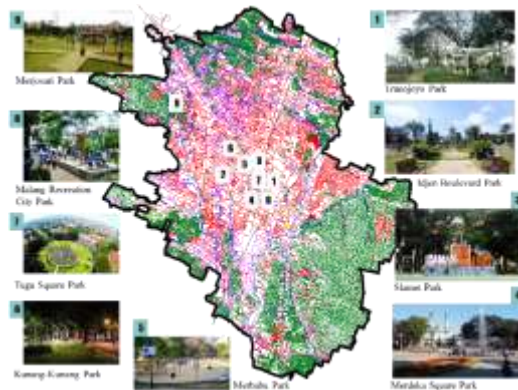


Figure 4. The position of Merjosari Park on the scale of Malang City

The Park has several green and natural elements such as fences, paths, seating, sand games, and gardens as shown in figure 5. The fence is in the form of potted plants produced from cement to create a partition between inside and outside the park. The pedestrian paths are interconnected with the width designed to be

between 1.5-2m and constructed in the form of paving which allows water absorption. Moreover, the gazebos and seats are generally made of wood while the sand play area is discovered to be the favorite place for children under 8 years old even though it is poorly maintained. The local trees are limited with quite diverse types of parks and gardens observed and the whole area was discovered to be dominated by green and natural elements.

Quality criteria of biophilic elements according to the experts

The AHP results showed experts 1, 2, 3, and 5 selected well-being as the highest criteria while the preferred highest sub-criteria was discovered to have varied with experts 1 and 2 observed to have selected safe room, 4 and 5 preferred playing equipment while 3 selected supporting facilities as indicated in table 1.



Figure 5. Condition of Merjosari Park, Malang City

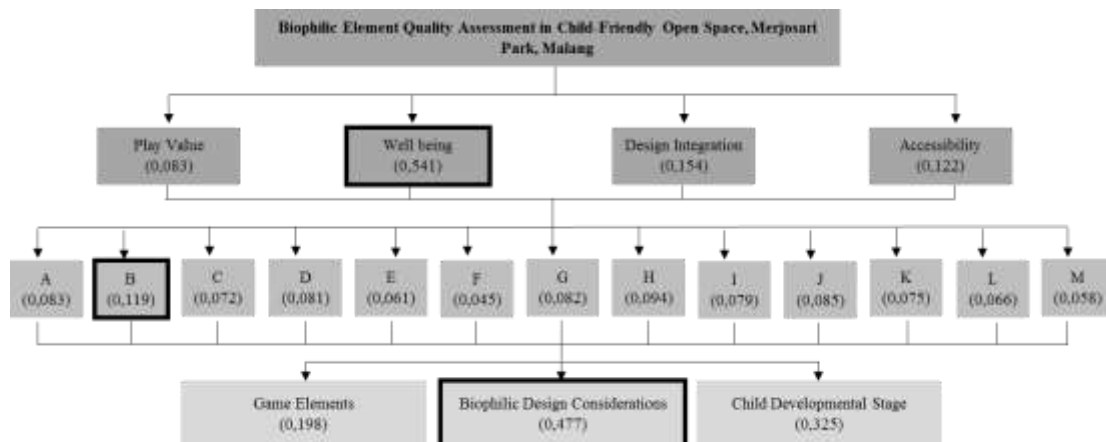


Figure 6. AHP calculation results related to the quality of biophilic elements in child-friendly open spaces

Table 1. AHP results for the highest criteria and sub-criteria for each expert

Expert	Criteria (value)	Sub criteria (value)
Expert 1	Well being (0,643)	Safe space (0,227)
Expert 2	Well being (0,587)	Supporting facilities (0,144)
Expert 3	Well being (0,341)	Safe space (0,173)
Expert 4	Playing value (0,431)	Playing equipment (0,204)
Expert 5	Well being (0,601)	Playing equipment (0,153)

The weighting results of all the experts showed the K2 criterion which is well-being had the highest average score of 0.541 as shown in figure 6. This is associated with the argument of 4 Experts that well-being is a priority in child-friendly open spaces. This finding is also in line with the opinion of Muñoz (2009) that a playing space needs to support the well-being of children in order to motivate them to be more daring to play.

The highest sub-criterion for the biophilic elements was found to be B which is the safe space with a value of 0.105 as indicated in figure 6. This is in accordance with the findings of Moore, Goltzman, and Iacofano (1992) that the creation of safe open space guarantees the health and welfare of children and avoids dangerous conditions.

Visitor's perception of the quality of biophilic elements

Most of the respondents represented by 58.97% visit the park in the afternoon while 41.03% visit in the morning between 07.00-10.00 am.

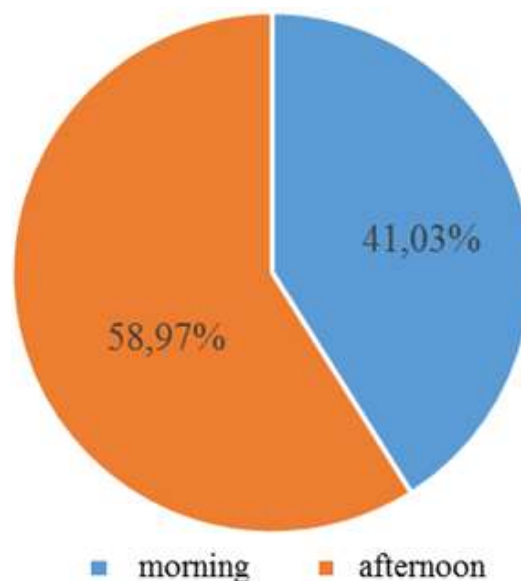


Figure 7. Percentage of respondents visiting Merjosari Park

The biophilic element discovered to have the highest importance value is the gardens with a total score of 154 and this is associated with the presence of different types of gardens in Merjosari Park including fruits, flowers, and several others. Meanwhile, the element with the lowest importance value is water play with 95 scores and this is attributed to the absence of water games facilities in the park.

Moreover, the biophilic element with the highest performance value was the safe space with a score of 164 and this is related to the consideration of the park as a safe place for the children due to its fairly relative distance from the highway, availability of a fence, and the existence

of many gazebos which makes it easier for parents to monitor their children. Meanwhile, the lowest performance value was recorded for the sand game with a score of 123 and this is due to the fact that the game is considered less safe and healthy for children. The sand has been condensed a lot and there is no area to supervise the children.

The seating element was recorded to have the highest suitability value with 159.30% and this is associated with the existence of many seats and gazebos which have suitable facilities to satisfy the needs of the visitors. The average value calculated showed the overall suitability level of Merjosari Park is 128.73% and this means its level of performance and importance meets the needs of the visitors due to the fact that it is higher than 100%.

Figure 8 shows the 13 biophilic elements used are distributed in 3 quadrants which include II, III, and IV and this means there is no element with high importance but low performance. The elements included in Quadrant II which achievement needs to be maintained include gardens with 4.03, distance from the road with 3.93, safe spaces with 3.86, entrance with 3.76, and roadway with 3.71. Gardens were considered appropriate due to the existence of different types, thereby, having the ability to increase the knowledge of the visitors, especially the children. Moreover, the distance, especially to the road, is considered appropriate due to the strategic siting of the park in a good location as well as the absence of vehicles considered dangerous to the children. The safe space, especially the safety aspect, is deemed efficient due to the presence of a fence that separates the activities inside and outside the park. Furthermore, the appropriateness of the entrance is due to its placement in a place not crowded with vehicles. The roadway is also deemed efficient due to its ability to connect the game area, sports, gardens, and others. The performance and importance of these five elements, therefore, need to be maintained.

The elements in quadrant III which are required to be prioritized low include play equipment elements with 3.3, tree with 3.21, sand games with 3.02, and water games with 2.9. The playing equipment was observed not to have met the performance and importance required despite the existence of different kinds of games due to their poor conditions. Moreover, the trees are considered insufficient even though there are several types with fewer local species, especially for the fruits. The sand games are considered inadequate because they are not in good condition while water games are non-existent in the park.

The elements in quadrant IV which are classified as excessive include fences with 3,48, marker with 3.38, seats with 3.31, and supporting facilities with 3.3. These elements are not prioritized in the arrangement of the park because they have good performance with relatively low importance. The fence is considered quite good due to its provision of security in the form of shrubs considered quite safe because of their height. Markers are considered quite good in providing information on natural elements, seating is rated quite well due to its natural design while supporting facilities such as bathrooms are considered good enough to fulfill hygiene infrastructure at an adequate quantity.

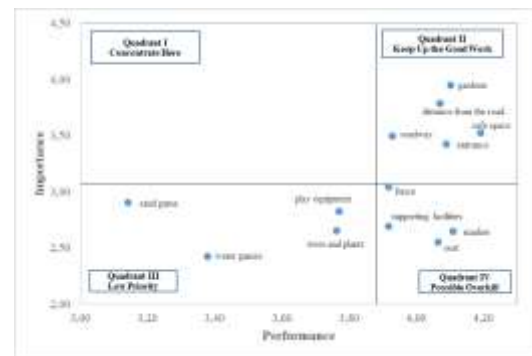


Figure 8. IPA quadrant of Merjosari Park visitors

Table 2. The weighting of interest levels and perceived performance of Merjosari Park visitors, Malang City

No.	Biophilic element	Total value		Conformity level	Average	
		Importance	Performance		Importance (X)	Performance (Y)
1	Distance from road	148	159	107,45%	3,79	4,07
2	Well-being	138	164	118,91%	3,53	4,19
3	Entrance	134	160	119,48%	3,42	4,09
4	Roadway	136	153	112,48%	3,49	3,93
5	marker	103	160	155,21%	2,65	4,11
6	Seat	100	159	159,30%	2,55	4,06

No.	Biophilic element	Total value		Conformity level	Average	
		Importance	Performance		Importance (X)	Performance (Y)
7	Fence	119	153	128,63%	3,04	3,92
8	Playing equipment	110	147	133,33%	2,83	3,77
9	Supporting facilities	105	153	145,48%	2,69	3,92
10	garden	154	160	103,90%	3,95	4,10
11	Tree	104	147	141,79%	2,65	3,76
12	Sand game	113	123	108,17%	2,90	3,14
13	Water games	95	132	139,42%	2,42	3,38

The development of the biophilic element quality in Merjosari Park

The quality of the biophilic element in Merjosari Park was developed using the results of the IPA and AHP analyses. This involved grouping the results of the IPA analysis by quadrant after which they were prioritized based on the AHP analysis and the elements in Quadrant III were developed due to the fact that they have a low-performance level.

Table 3. Prioritization of Merjosari Park elements based on the AHP weight value

Element	Priority value	Development
Playing equipment	0,083	<ul style="list-style-type: none"> • Symbolic game • Sensory-motor game
Tree	0,073	<ul style="list-style-type: none"> • Plant arrangement • Fruit tree • Local plants
Sand game	0,067	<ul style="list-style-type: none"> • Area expansion • Sand type repair
Water game	0,055	<ul style="list-style-type: none"> • Floor cleanlines • Arrangement of water type and quality

This proposal was made in line with the results of the AHP analysis with the experts discovered to have stated the development using the biophilic design had the highest value of 0.477 when compared to the stage of child development with 0.325 and game elements with 0.198. This means the improvement of the Merjosari Park design needs to be prioritized while the harmony of the natural environment is maintained through different types of games which are considered safe and healthy for the children. This is in accordance with the opinion of [Jamshidi, Parker, and Hashemi \(2020\)](#) that the biophilic design factors affecting human health include the aspects of facilities, shapes, and layouts. It is also in line with the findings of [Parsons \(2011\)](#) that the elements of design are important to the development of movement and basic skills, games, creative thinking, problem-solving skills,

symbolic games, role-playing, and fantasy games for children.

Some of these findings strengthen the initial assumption of this research that biophilic design is the main factor in shaping the quality of child-friendly open spaces through natural elements.

Conclusion

The findings showed the biophilic element criterion with the most influence on child-friendly open spaces in Merjosari Park, Malang City is well-being while safe space is the highest sub-criterion. Their elements are, therefore, required to be prioritized in developing child-friendly open spaces.

The biophilic element with the highest level of suitability was found to be the seat, the element with the highest level of importance is the garden while the element with the highest level of performance is the safe space. Moreover, the elements required by the visitors to be prioritized include playing equipment followed by trees, sand games, and water games. Meanwhile, the experts showed the basic criteria for biophilic design have more value than those for the stage of child development and different types of games. Therefore, the most important biophilic element for the child-friendly open spaces based on experts' opinions and visitors' perceptions is the safe space. Furthermore, it was discovered that biophilic elements play a very important role in providing health, safety, and well-being to children in their playgrounds.

The author is grateful to Brawijaya University for funding this research through the NLK Doctoral Grant.

References

- Abdelaal, Mohamed S. 2019. 'Biophilic Campus: An Emerging Planning Approach for a

- Sustainable Innovation-Conductive University'. *Journal of Cleaner Production* 215 (April): 1445–56. <https://doi.org/10.1016/j.jclepro.2019.01.185>.
- Bahauddin, Azizi, Rani Prihantmanti, and Josephine Ong. 2021. 'Biophilic Design Patterns and Local Knowledge of Plants Application in Baba-Nyonya Heritage Shophouses' Courtyard'. *ARTEKS: Jurnal Teknik Arsitektur* 6 (2): 305–14. <https://doi.org/10.30822/arteks.v6i2.757>.
- Berg, Agnes E. Van den, Yannick Joye, and Sander L. Koole. 2016. 'Why Viewing Nature Is More Fascinating and Restorative than Viewing Buildings: A Closer Look at Perceived Complexity'. *Urban Forestry & Urban Greening* 20 (December): 397–401. <https://doi.org/10.1016/j.ufug.2016.10.011>.
- Bosch, M. van den, and Å Ode Sang. 2017. 'Urban Natural Environments as Nature-Based Solutions for Improved Public Health – A Systematic Review of Reviews'. *Environmental Research* 158 (October): 373–84. <https://doi.org/10.1016/j.envres.2017.05.040>.
- Chen, Xianwen, Sjerp de Vries, Timo Assmuth, Jan Dick, Tia Hermans, Ole Hertel, Anne Jensen, et al. 2019. 'Research Challenges for Cultural Ecosystem Services and Public Health in (Peri-)Urban Environments'. *Science of The Total Environment* 651 (February): 2118–29. <https://doi.org/10.1016/j.scitotenv.2018.09.030>.
- Elsadek, Mohamed, Minkai Sun, Ryo Sugiyama, and Eijiro Fujii. 2019. 'Cross-Cultural Comparison of Physiological and Psychological Responses to Different Garden Styles'. *Urban Forestry & Urban Greening* 38 (February): 74–83. <https://doi.org/10.1016/j.ufug.2018.11.007>.
- Fisher, Jack E, Zorana J Andersen, Steffen Loft, and Marie Pedersen. 2017. 'Opportunities and Challenges within Urban Health and Sustainable Development'. *Current Opinion in Environmental Sustainability* 25 (April): 77–83. <https://doi.org/10.1016/j.cosust.2017.08.008>.
- Hasibuan, Friska, Fermanto Lianto, Samsu Hendra Siwi, and Martinus Bambang Susetyarto. 2021. 'Utilization of Public Open Space in Kampung Deret Petogogan Jakarta'. *ARTEKS: Jurnal Teknik Arsitektur* 6 (2): 189–98. <https://doi.org/10.30822/arteks.v6i2.654>.
- Hwang, Yun Hye, and Charlotte J. Roscoe. 2017. 'Preference for Site Conservation in Relation to On-Site Biodiversity and Perceived Site Attributes: An on-Site Survey of Unmanaged Urban Greenery in a Tropical City'. *Urban Forestry & Urban Greening* 28 (December): 12–20. <https://doi.org/10.1016/j.ufug.2017.09.011>.
- Jamshidi, Saman, Jan S. Parker, and Seyedehtasharan Hashemi. 2020. 'The Effects of Environmental Factors on the Patient Outcomes in Hospital Environments: A Review of Literature'. *Frontiers of Architectural Research* 9 (2): 249–63. <https://doi.org/10.1016/j.foar.2019.10.001>.
- Jesus Henriques Silva, Fátima De, and Paula Odete Fernandes. 2011. 'Importance-Performance Analysis as a Tool in Evaluating Higher Education Service Quality: The Empirical Results Of Estig (IPB)'. In *Creating Global Competitive Economies: A 360-Degree Approach - Proceedings of the 17th International Business Information Management Association Conference, IBIMA 2011*, 4:306–15. Bragaça, Mirandela: Instituto Politecnico De Braganca. https://bibliotecadigital.ipb.pt/bitstream/10198/7120/1/IBIMA_2.pdf.
- Kambo, Amrita, Robin Drogemuller, and Prasad K.D.V. Yarlagadda. 2019. 'Assessing Biophilic Design Elements for Ecosystem Service Attributes – A Sub-Tropical Australian Case'. *Ecosystem Services* 39 (October): 100977. <https://doi.org/10.1016/j.ecoser.2019.100977>.
- Kuldna, Piret, Dr Helen Poltimäe, and Heidi Tuhkanen. 2020. 'Perceived Importance of and Satisfaction with Nature Observation Activities in Urban Green Areas'. *Journal of Outdoor Recreation and Tourism* 29 (March): 100227. <https://doi.org/10.1016/j.jort.2019.100227>.
- Lee, Seung Hyun. 2019. 'Effects of Biophilic Design on Consumer Responses in the Lodging Industry'. *International Journal of Hospitality Management* 83 (October): 141–50. <https://doi.org/10.1016/j.ijhm.2019.05.006>.
- Liem, Yoseph, and Reginaldo Chistophori Lake. 2018. 'Pemaknaan Ruang Terbuka Publik Taman Nostalgia Kota Kupang'. *ARTEKS:*

- Jurnal Teknik Arsitektur* 2 (2): 149–58.
<https://doi.org/10.30822/arteks.v2i1.48>.
- Ling, Tzen-Ying, and Yi-Chang Chiang. 2018. 'Well-Being, Health and Urban Coherence-Advancing Vertical Greening Approach toward Resilience: A Design Practice Consideration'. *Journal of Cleaner Production* 182 (May): 187–97.
<https://doi.org/10.1016/j.jclepro.2017.12.207>.
- Lotfi, Yomna A., Mohammed Refaat, Mohammed El Attar, and Aassem Abdel Salam. 2020. 'Vertical Gardens as a Restorative Tool in Urban Spaces of New Cairo'. *Ain Shams Engineering Journal* 11 (3): 839–48.
<https://doi.org/10.1016/j.asej.2019.12.004>.
- Mangone, Giancarlo, Colin A. Capaldi, Zack M. van Allen, and P.G. Luscuere. 2017. 'Bringing Nature to Work: Preferences and Perceptions of Constructed Indoor and Natural Outdoor Workspaces'. *Urban Forestry & Urban Greening* 23 (April): 1–12.
<https://doi.org/10.1016/j.ufug.2017.02.009>.
- McCracken, Deborah S., Deonie A. Allen, and Alan J. Gow. 2016. 'Associations between Urban Greenspace and Health-Related Quality of Life in Children'. *Preventive Medicine Reports* 3 (June): 211–21.
<https://doi.org/10.1016/j.pmedr.2016.01.013>.
- Meidenbauer, Kimberly L., Cecilia U.D. Stenfors, Jaime Young, Elliot A. Layden, Kathryn E. Schertz, Omid Kardan, Jean Decety, and Marc G. Berman. 2019. 'The Gradual Development of the Preference for Natural Environments'. *Journal of Environmental Psychology* 65 (October): 101328.
<https://doi.org/10.1016/j.jenvp.2019.101328>.
- Moore, Robin C., Susan M. Goltsman, and Daniel S. Iacofano. 1992. *Play For All: Guidelines*. Berkeley: MIG Communication. Berkeley: CA: MIG Communications.
- Muñoz, Sarah-Anne. 2009. 'Children in the Outdoors: A Literature Review'. *Sustainable Development Research Centre*. Sustainable Development Research Centre on Behalf of the National Sustainable Development Centre with Support from the Forestry Commission.
- Parsons, Ashley. 2011. 'Young Children and Nature: Outdoor Play and Development, Experiences Fostering Environmental Consciousness, And the Implications on Playground Design'. Virginia Polytechnic Institute and State University.
https://vtechworks.lib.vt.edu/bitstream/handle/10919/32281/Parsons_AE_T_2011.pdf?sequence=1&isAllowed=y.
- Purnomo, Estining Nur Sejati, Sari Widya Sihwi, and Rini Anggrainingsih. 2013. 'Analisis Perbandingan Menggunakan Metode AHP, TOPSIS, Dan AHP-TOPSIS Dalam Studi Kasus Sistem Pendukung Keputusan Penerimaan Siswa Program Akselerasi'. *Jurnal Itsmart* 2 (1).
<https://jurnal.uns.ac.id/itsmart/article/view/612/564>.
- Tantarto, Dhini Dewiyanti, and Dianna Astrid Hertoery. 2020. 'The Role of Space in Sustaining Children's Traditional Games'. *ARTEKS: Jurnal Teknik Arsitektur* 5 (3): 359–72.
<https://doi.org/10.30822/arteks.v5i3.504>.
- Tsantopoulos, Georgios, Gregory Varras, Ekaterini Chiotelli, Konstantina Fotia, and Maria Batou. 2018. 'Public Perceptions and Attitudes toward Green Infrastructure on Buildings: The Case of the Metropolitan Area of Athens, Greece'. *Urban Forestry & Urban Greening* 34 (August): 181–95.
<https://doi.org/10.1016/j.ufug.2018.06.017>.
- Yin, Jie, Shihao Zhu, Piers MacNaughton, Joseph G. Allen, and John D. Spengler. 2018. 'Physiological and Cognitive Performance of Exposure to Biophilic Indoor Environment'. *Building and Environment* 132 (March): 255–62.
<https://doi.org/10.1016/j.buildenv.2018.01.006>.