

**KEY WORDS:**

Neighbourhood Parks, Recreational Spaces, Space Character, User's Perception

## Measuring Responsiveness of Public Open Spaces: a case of Nagpur city, India

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**ABSTRACT**

Historically, public open spaces (POSS) have played an important role in people's lives by providing opportunities for relaxation and recreation. POSS allows people of all ages to visit and participate in various recreational activities that make them happy. However, POSS in Indian cities are experiencing severe issues that are affecting their performance and usability. This study focuses on 'space responsiveness,' a comprehensive and user-centered approach that deals with POSS' physical, functional, social, aesthetical, economic, and environmental characteristics. Space responsiveness facilitates users to utilise, interpret and perceive the space. It provides a democratic setting and vibrant environment that enhance user experience. The study aim is to measure POSS' responsiveness at the individual, community, and environmental levels. It identifies the strengths and deficiencies of POSS. The study aids in determining how these POSS are performing. Three parks in the fast-growing city Nagpur are selected for the study. The study collected primary data using a variety of tools. First, the opinions of users were gathered via a questionnaire survey. Second, semi-structured interviews were used to elicit users' perspectives on POSS. Third tool, observation aided in identifying physical attributes as well as user activities within the POSS. The study proposes Space Responsive Index (SRI) to measure POSS. The study offers a set of practical recommendations for developing initiatives and policies to develop sophisticated POSS in cities and improve citizens' quality of life.



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## Introduction

Indian cities are experiencing urbanisation at a rapid pace since last five decades. Opportunities for employment, business, and education are attracting a large number of migrants from surrounding villages to cities. This situation is resulting in socio-economically diverse cities in India (Chaudhry et al., 2011; Subramanian and Jana, 2018). High dense population, compact houses, massive traffic movement, and increased pollution level are some consequences that deteriorating city's quality of life. City dwellers need a platform where they can spend leisure time, connect with nature, enhance their social bonding and engage with various recreational activities. In this case, public open spaces (POSSs), particularly parks, play an important role and have become a critical necessity in cities. POSSs make the city livable, healthy, and pleasant for its citizens (Gehl, 2011; PPS, 2019). However, urbanization is decreasing the quality of existing POSSs and affects their physical, functional, social, aesthetical, economic, and environmental characteristics (Singh et al., 2010; Chaudhry et al., 2011; MoUD, 2014; Subramanian and Jana, 2018; Ahirrao and Khan, 2022). These POSSs not only limit users' use, perception, and interpretation but also affect space-users attachment and sense of belonging. Here, 'space responsiveness' proves helpful to enhance the usability of POSSs. The 'responsiveness' is the quality of space that allows democratic setting, maximum choices and provide freedom in activities. It also successfully accommodates a variety of activities within POS, promotes the public realm, and positively responds to the social, built, and natural environments (Bentley et al., 1985; Perera, 2001; Charkhchian and Daneshpour, 2009; Carmona et al., 2010).

The extant literature on POSSs is mostly based on studies undertaken in industrialised or high-income countries, with relatively little known about developing or middle income countries, particularly India. Some studies conducted on POSSs in Indian context explore biodiversity, landscape, and climate aspects (Singh et al., 2010; MoUD, 2014; Subramanian and Jana, 2018; Uma, 2018 ). Fewer studies are available that elaborate the POSSs responsiveness through urban planning and design perspective. Current study fulfils the existing research gap and contributes to the growing body of literature. The study aim is to measure POSSs' responsiveness at the individual, community, and environmental levels in order to determine their strengths and deficiencies. For evaluation, three active parks have been selected through specific criteria from the fast-growing city Nagpur. The study offers a set of practical recommendations for developing initiatives and policies to develop sophisticated POSSs in cities. The recommendations can be used by planners and designers in other similar cities around the world to improve the usability POSSs in their cities.

## Defining Space Responsiveness

'Responsiveness' is an ambiguous term and scholars used it in different circumstances. Bentley et al. (1985) and McGlynn et al. (2013) explained, 'it is a space response to users activities and may obtain by providing maximum choices within the space'. They also argued that responsiveness make POSSs democratic, inclusive and meaningful. Perera (2001) explained responsiveness connects human values and activities to space to create

an image that describes the true nature of that environment. Charkhchian and Daneshpour (2009) argued responsiveness is the mode of communication between space and users that help users to utilise, interpret and perceive the space. Scholars argued that various aspects must be taken into consideration when designing spaces for different groups of users. Carmona et al., (2010) suggested characteristics such as permeable, varieties, legible, robust, vibrant and personalised to explain space responsiveness. Space responsiveness allows users to understand the space such as where they should go, what facilities and services are available, how space aesthetically rich, and what type of activities space could offers for recreation. Responsiveness acts as a link between the space's character and people's use, perception and interpretation. Here, perception means 'a process of conceiving any visual or non-visual formation through sensory stimuli to become aware of it, get knowledge and understand that help to make an identity in perceiver's mind' (Lynch et al., 1984; Ujang et al., 2018). A visual formation can be perceived through its external appearances such as colour, shape, and texture. Whereas non-visual formation may be perceived through its smell, sound, and feel. Interpretation term indicates the action of explaining, reframing or describing something (Field and Wagar, 1973). Interpretation explores the understanding of the explainer. To interpret first, it requires understanding the characters through the visual or non-visual formation and then giving judgment on it.

The high responsiveness of the space denotes the high quality of physical, functional, social, aesthetical, economic, and environmental characteristics, as well as the high level of user satisfaction. It also indicates high possibility of user - space attachment, sense of belonging and pride. 'Space attachment' occurs when users regard a space as important because of its ability to meet their needs and support their behavioural goals (Ujang et al., 2018). It is the result of user-space interaction. 'Space belonging' refers to positive acceptance, show respect and take care of space by users (Glover, 2017). **Figure 1** shows the relationship between public open space and users.

### **Space Responsiveness: Levels, Aspects and Variables considered for the evaluation**

This study proposes a comprehensive approach to measuring space responsiveness. It includes three levels of evaluation: individual, community, and environment. First, Individual level responsiveness investigates an individual user's thoughts, feelings, and behaviour when he or she uses the space. Individual level responsiveness is defined by two aspects: physical and psychological. Physical responsiveness evaluates various variables that provide physical convenience to a user. These variables include location, access, furniture, activities, safety and essential facilities. A growing literature also draws attention to the importance of such variables. Scholars argued that the availability of convenient furniture and signage proportional to human scale improves users' physical convenience (Whyte, 1980; PPS, 2019). Recognisable location, highlighted and welcoming entrance assist users to identify the space from long distance and encourage them to enter within it.

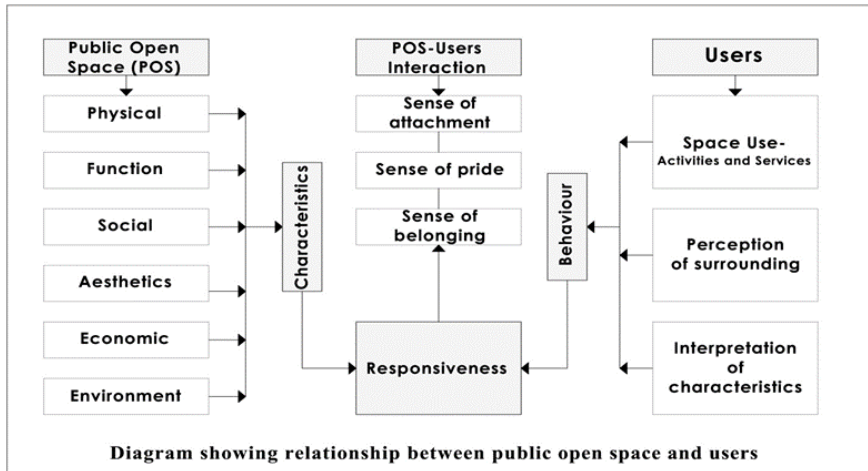


Figure 1: Diagram showing relationship between public open space and users

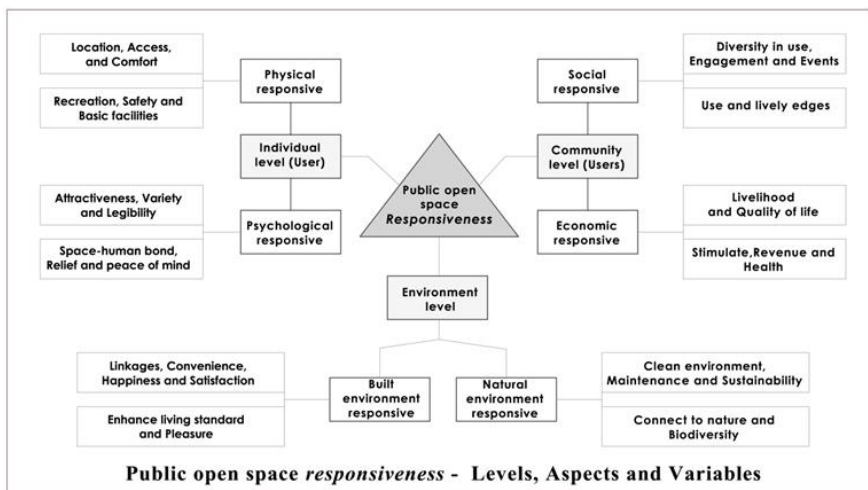


Figure 2: Public open space responsiveness –Levels, Aspects and Variables

Other factors that improve space utilisation include walkable pathways (Carr et al., 1992; Parra et al., 2010; Gehl, 2011; Carmona, 2019; Basu and Nagendra, 2021) and active and passive recreation activities (Woolley, 2003). Active recreation activities include sports, plays gathering and other physical activities where a user directly involves in it. Whereas passive recreation activities include watching and hearing other people, looking at views, resting, reading, and meeting with friends. User’s safety within the space is another

important variable included in the study. It evaluates safety measures of the space especially for women, children and senior citizens. Scholars such as Mehta, (2014), Mahadevia and Lathia, (2019) recommended users' safety in their studies. Some essential facilities like washrooms and drinking water considered in physical responsiveness. Psychological responsiveness deals with variables such as space's attractiveness, variety, legibility, space-human bond and peace of mind. Space attractiveness provides a high probability of evoking an image to users and helps them to generate positive memories. These memories give psychological comfort and pleasure to users (Lynch et al., 1984; Ujang et al., 2018; Barker et al., 2019; Grilli et al., 2020). Other features like public art, beautiful landscape, and sculptures provide sensory complexity and make space memorable (Whyte, 1980).

The second level describes the space responsiveness at the community level. It includes social and economic aspects. Social responsiveness considers variables such as space diversity, engagement, lively edges and opportunity to celebrate various events. Whyte (1980) and PPS (2019) argued that space should promote diversity. Presence of people of different age groups, class, gender, and religions within the space enhance space character. Space should promote various activities to users that facilitate their engagement with space. These activities can be classified as social, necessary and optional (Gehl, 2011). Other activities that allow people to have snacks, drinks, and purchase various items increase people's stay within and around the space (Low and Smith, 2013; PPS, 2019; Kim, 2019). These activities may be placed at the edges of space that make them live and active. Other notable features include the ability of POSs to commemorate various events. Furthermore, space flexibility encourages accommodating changes based on user requirements and necessity, which improves the space's social responsiveness. Another consideration is economic responsiveness, which is concerned with the livelihood of people who own and operate various commercial businesses near or around POSs. According to the literature, well-designed spaces attract more users and contribute to the success of surrounding businesses (Chaudhry et al., 2011; Kim, 2019).

The environment is the third level of evaluation for space responsiveness. In this case, the study considers two factors of the environment, i.e. 'built' and 'natural'. The first factor, built environment responsiveness, investigates 'linkages,' or how POSs connects to other areas of the city. Another variable, 'convenience,' ensures environmental friendly public transportation (mass transportation), allowing users to reach POSs in a convenient manner. Linkages and convenience ensure that more users can visit the space and benefit from it (Banerjee, 2001; Carr et al., 1992 ). The satisfaction of neighbourhood occupants is an another variable that contributes to the built responsiveness (Charkhchian and Daneshpour, 2009). Occupants may convey their satisfaction in the form of pleasure, proud, and happiness. Furthermore, natural environment responsiveness focuses on space ability to reduce heat island effect, provide fresh air and cool climate to neighbourhood occupants. Aspect also examines the space's ability to promote sustainable practices and flora and fauna (Uma, 2018). **Figure 2** shows space responsiveness levels, aspects and variables considered for the study.

## Study Area

Nagpur is one of India's fastest growing cities, with the thirteenth largest urban agglomeration. It is the third largest city in the Indian state of Maharashtra, after Mumbai and Pune and located at 21.15°N 79.08°E. It has recorded a 2.4 million population with a 92% literacy rate in the census conducted in the year 2011. Nagpur Municipal Corporation (NMC) created the City Development Plan-2041 (CDP-2041), which forecasts 29 percent and 35 percent population growth in 2021 and 2031, respectively. The city is still attracting people from other districts, states and offering them opportunities such as education, jobs, and business. NMC jurisdiction boundaries cover 225.08 Sq. Km area. The authority-owned large numbers of POSs that provide free entry to citizens. NMC is also in charge of the POSs' design, development, and management. Observations suggest that most of the citizens from different social, income and age groups prefer to visit free entry POSs for leisure, recreation, get together and exercise as a part of their daily or weekly routine. POSs that offer free entry were considered for the study due to the availability of higher numbers in the city and visitors' preference to visit.

It is essential to mention here, this article is part of the research project to identify the responsiveness of POSs at the individual, community, and environmental levels. The researcher visited nine POSs ranging from two to seven acres, located in different parts of the city, owned by NMC and offer free entry to users. These visits conducted at a different time of the day during November – December 2019 with the aim to record available facilities, users' activities and their visitation pattern through photographs, mapping and observations. Scholars such as Whyte, (1980), Gehl, (2013), Carmona, (2019) supported the method in their respective studies. The researcher also visited adjoining neighbourhoods of these spaces. The goal was to identify and include diverse social and income groups in the study by conducting interviews with them. It aided researchers in gathering broad-level information about users, their perspectives, and expectations of the spaces. In addition, the researcher confirmed the presence of small shops, hotels, and street food vendors near the POSs. Jacobs (1961) argued that occupants who stayed near POSs and people involved in small commercial activities that occurred near the spaces for a long time may consider as a valuable source of information. Out of these nine POSs, three POSs namely Shivaji Park (SP), measuring 4.0 Acres, located in the west zone of the city, Deshpande Park (DP), measuring 3.5 Acres, located in CBD zone and Lata Mangeshkar Park (LMP), measuring 6.5 Acres located in the east zone were selected for the main study. These POSs were chosen based on criteria such as location, ownership, and the presence of visitors of all ages within the space, variety in use, maximum daily footfall, adjacent commercial activities, and a neighbourhood with residents from a variety of social and economic backgrounds. All three POSs are open to citizens for four hours in the morning (6.00 to 10.00 a.m.) and evening (4.00 to 8.00 p.m.). Peak hours for the majority of POSs were observed to be from 6.30 to 8.30 a.m. and 5.00 to 7.30 p.m. **Figure 3** shows the location map and **Figure 4, 5 and 6** show Google earth images of these selected POSs.



Figure 3: Location Map



Figure 4: POS-1 Shivaji Park (SP) and surrounding area



Figure 5: POS-2 Deshpande Park (DP) and surrounding area



Figure 6: POS-3 Lata M. Park (LMP) and surrounding area

## Research Methods

The study adopts mixed approach due to its ability to supports the aim of the study. It combines the benefits of quantitative and qualitative approaches. The approach also helps to generalise the result over the vast population (Thomas, 2003). To collect primary data, it employs three methods: self-administered questionnaire surveys, observations, and semi-structured interviews. Self-administered questionnaire was developed to get users' perceptual response that explores functional, aesthetical and perceptual capabilities of the space. The method assist researcher to understand the space through users' point of view. It has an advantage as compared to other data collection instruments that it proved inexpensive and time-saving. Scholars such as Akalin et al., (2009), Mehta, (2014), Askari and Soltani, (2019), Gaikwad and Shinde, (2019) and Zamanifard et al.,(2019) have supported and employed such method in their studies. Another method, semi-structured interview was conducted with occupants who live adjoining neighbourhoods of POSs and operators/owners those owned shops, hotels and street food businesses located near the spaces to know how POSs impact on their day-to-day life. It helps researcher to get their opinion on variables such as social, economic, built and natural environment. Charkhchian and Daneshpour (2009), and Gaikwad and Shinde, (2019) recommended semi-structured interview method in their studies. The third method, observations facilitates the researcher to analyse the users' activities and behaviour within the space. Scholars such as Whyte (1980) and Gehl (2011) have suggested using observation to identify important characteristics of the space.

The study proposes the Space Responsiveness Index (SRI) for measuring POSs. It contains three levels, six aspects and thirty measuring items. Among these, the POS users rated ten measuring items included in the self-administered questionnaire. The researcher rated twelve items through observation. Eight items were rated by adjoining neighbourhood occupants and owners of shops, hotels, and people involved in street food businesses through interviews. All measuring items were scored on a five-point Likert scale, with 1 meaning "no," 2 meaning "somewhat," 3 meaning "moderately," 4 meaning "mostly," and 5 meaning "yes." The Likert scale is a type of intelligent response that is frequently employed in questionnaire surveys. Scholars such as Ryan, (2005), Akalin et al., (2009), Askari, and Soltani, (2019) emphasised the efficiency of such kind of scaling in similar studies. To obtain a comparative analysis of the results, the total mean scores were converted into a percentage.

A pilot study is a crucial stage in social research to identify the capability of the instrument and errors in the survey (De vau, 2002; Fink, 2003). In the first week of January 2020, a pilot study with 50 users was done to assess the efficiency, language, and sequence of the questionnaire, time taken by respondents to complete the questionnaire, and general participant interest in the survey. The researcher made certain that the questionnaire accurately reflected the respondent's perception of the space. Some questions reconstructed as easy to understand and straight forward as possible to explore respondents' opinion, that helps to increase the reliability of the main survey. Questions were associated with users' demographic data and various aspects of the study. Researcher considered one-week footfall of each POSs, margin of error +/- 5% and



confidence level of 95% to identify individual space' sample size. This method adopted due to the unclear ward population on latest government records and non-existence of entry registers at POSs. The main survey was conducted by the researcher and three architecture graduate attendees. The survey was open to people aged 18 and up. The researcher informed POS visitors about the aim and objectives of the study at the main entrance and asked them to participate in the questionnaire survey. The method supported, and employed by scholars such as Sreetheran, (2017), Gaikwad and Shinde, (2019) and Askari, and Soltani, (2019) in their studies. Participation in the survey was entirely voluntary, and there was no inducement for respondents to do so.

Snowball sampling was used to conduct a semi-structured interview. Occupants, who live at the adjoining neighbourhood, frequently visited space and people who own and operate shops, hotels and involve in other commercial activities near or around the space for a long time were identified and approached. The aim, objectives of the study and measuring items explained to them in the same tone, and their opinion recorded in a digital audio recording device. The interview of a person lasted between 10 to 12 minutes. For observations, a separate sheet prepared for the researcher with the Likert scale. The main survey included 105 respondents from SP, 127 from DP, and 79 from LMP. Data was collected in SP from 19 to 30 January 2020 (twelve days), DP from 1 to 13 February 2020 (thirteen days) and LMP from 15 to 25 February 2020 (ten days) including weekdays and weekend in bright sky condition with an average temperature of 16 to 30 degree celsius.

For data analysis, SPSS (version-25) was used. In this study, the mean, standard deviation, and percentage were calculated using a descriptive statistic method. This method is used and recommended by Aram et al., (2019) and Romolini et al.,(2019). At the same time, Cronbach's reliability and Pearson's correlation coefficient tests were used to identify values and relationships between items and aspects, as recommended by Sakip et al. (2015) and Askari and Soltani (2019).

## Results

As mentioned earlier, the study aims to evaluate the POSs responsiveness at individual, community and environment level to determine their strengths, deficiency, and capabilities to satisfy the needs of users. The results are divided into three sections.

### Respondent characteristics and POSs visitation

The main survey had 311 respondents from all three POSs. In all POSs, male respondents responded at a higher rate than females. Users having diverse age, education and occupation recorded their response in the survey. A higher response received from users having the age group of 25-39 and 40-59 in DP, LMP and SP respectively. Most of the respondents completed their degree-level education. A higher response noted from retired persons (23.8 %) in SP, employees that belong to private sector (29.1 %) in DP, and students of various institutions (25.3 %) in LMP. **Table 1** shows respondents characteristics of all three POSs in detail.

Survey also enquired about users' frequency to visit the space and identified that users those visited the space a few times of the week recorded higher in SP and LMP. It was 43.8 % and 43% respectively. This category includes users those engaged with active, passive and other social activities. Whereas, users those visited the space once in day recorded higher in DP with 37 %. Users who engage in physical activities such as exercise, walking, and yoga are considered in this category. These users visited space as an individual or a group. Another survey that determined how far users typically travel to visit the space found that people living in areas more than 0.5 kilometres but less than 2.0 kilometres from spaces visited the space more frequently than those living a long distance away. Users who reside more than 5.0 kilometres away prefer to visit the spaces only on occasion.

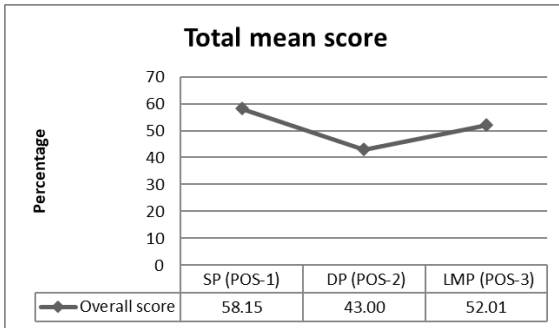
**Table 1 : Respondent characteristics**

Sr.No.	Characteristics	SP (POS-1) (n = 105)		DP (POS-2) (n= 127)		LMP (POS-3) (n =79)	
		Count	Percentage	Count	Percentage	Count	Percentage
		1	<b>Gender</b>				
	Male	65	61.9	75	59.1	44	55.7
	Female	40	38.1	52	40.9	35	44.3
2	<b>Age group</b>						
	18-24 years	17	16.2	24	18.9	22	27.8
	25-39 years	29	27.6	44	34.6	28	35.4
	40-59 years	34	32.4	38	29.9	20	25.3
	60 years and above	25	23.8	21	16.5	9	11.4
3	<b>Education level</b>						
	School	8	7.6	6	4.7	2	2.5
	Junior College	17	16.2	27	21.3	18	22.8
	Degree	48	45.7	66	52.0	43	54.4
	Post graduation	26	24.8	25	19.7	12	15.2
	Doctorate	2	1.9	1	.8	4	5.1
	Post Doctorate	3	2.9	0	0	0	0
	Not visited school	1	1.0	2	1.6	0	0
4	<b>Occupation</b>						
	Government servant	16	15.2	10	7.9	6	7.6
	Private Sector	21	20.0	37	29.1	18	22.8
	Self Employed	19	18.1	17	13.4	12	15.2
	Retired	25	23.8	21	16.5	12	15.2
	Student	17	16.2	29	22.8	20	25.3
	Housewife	5	4.8	13	10.2	6	7.6
	Not working/Searching for Job	2	1.9	0	0	5	6.3
5	<b>Footfall measured (one week)</b>	143		189		99	

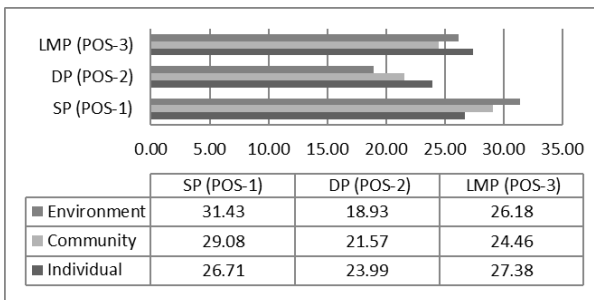
**Responsiveness index-POs mean scores**

The responsiveness index includes three levels, i.e. individual, community and environment. Here, SP obtained the highest total mean score (i.e. the sum of all levels mean) of 58.15 % while compared to the other two POs. The LMP stood second in the category with 52.01 % and DP at third POSition with least score, i.e. 43.00 %. The overall result shows SP contains more characters and offers maximum choices to their users that increase its responsiveness. **Figure 7 and 8** show the total mean score received by POs in detail.

Now describing the ‘level wise’ scores, individual-level contained physical and psychological aspects. In the physical aspect, SP got 55.74%, which is the highest score in the category. It is due to its ability to provide convenient access, comfortable furniture and necessary facilities to users. LMP received the highest score, 57.77 % in the psychological aspect. Users perceived this space more attractive. They argued that space has variety in its elements and promote relief and peace of mind. However, DP scored the least score in both aspects. **Figure 9** describes scores received by POs at the individual level.



**Figure 7:** Total mean score (Percentage)



**Figure 8:** Distribution of total mean score (Percentage)

Community-level included social and economic aspects. In the social aspect, SP received the highest score, i.e. 62.9 %. The features that give higher score are ‘space ability to offer various activities’ and ‘hosts different events for users’. On the other side, SP and LMP both received excellent scores in economic aspect. Owners of shops and hotels located near the spaces argued that spaces have economically enhanced their businesses. Space users also enjoy shopping and food by visiting their shops and hotels. Same, the occupants living adjoining neighbourhoods of these POSs believed that spaces reduced their health expenditure. At last, environment level focuses on built and natural aspects; here SP received the highest score in both aspects. Space well connected to surrounding areas with roads and footpaths, offers a good natural environment, enhance the living standard of the occupants and promote biodiversity. Table 2 shows the result of space responsiveness index for three POSs. **Figure 9** and **figure 10** show score gained by POSs at community and environment level, respectively. In addition, **Figure 12** depicts the scores (percentage) of all aspects in the form of a comparative web diagram.

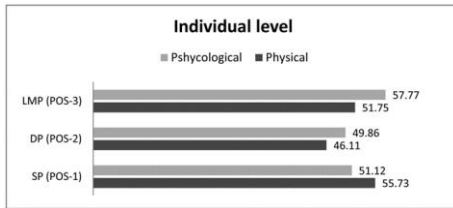


Figure 9: Individual level mean score (Percentage)

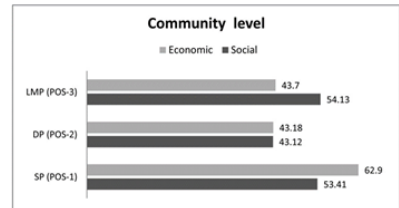


Figure10: Community level mean score (Percentage)

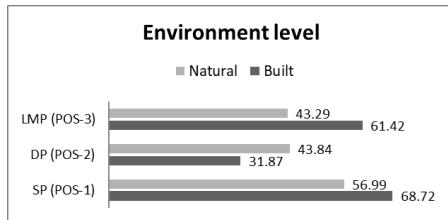


Figure 11: Environment level mean score (Percentage)

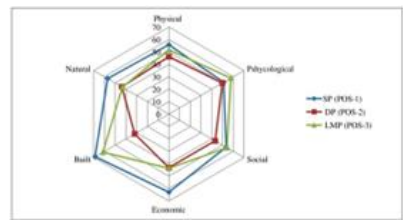


Figure 12: Comparative web diagram showing all aspects scores (Percentage)

Sr. no	Aspect	Variable	Sr. no	Measuring Item	Score (Maximum)	SP (POS-1)	DP (POS-2)	LMP (POS-3)
<b>Individual level</b>								
1	Physical	Location and access	1	Space is easy to identify, offers convenient access and walkable pathways	5	3.21	2.16	2.71
		Comfort	2	Space includes convenient furniture, readable signage, and details concerning to human scale	5	3.02	1.88	3.30
		Recreation	3	Space promotes active and passive recreational activities	5	2.81	2.94	2.42
		Safety	4	Space is safe for woman, children and senior citizens	5	2.11	2.17	2.37
		Basic facilities	5	Space provides basic facilities like clean washrooms and drinking water	5	2.78	2.39	2.14
2	psychological	Attractive-ness	6	Space includes memorable architecture, public art and landscape features.	5	2.15	2.17	2.76
		Variety	7	Variety of landscape elements within the space that providing sensory complexity	5	2.65	2.98	3.54
		legibility	8	Perceived image (legibility) of space that easy to recognise	5	2.56	3.00	2.85
		Space-human bond	9	User feels sense of attachment with space	5	3.10	1.86	2.99
		Relief and peace of mind	10	Space offers ease to users that give them relief and peace of mind	5	2.31	2.46	2.30
<b>(Individual level) Total score</b>					<b>50</b>	<b>26.71</b>	<b>23.99</b>	<b>27.38</b>
<b>Table 2: Result of Space Responsive Index (SRI) for three POSs</b>								
<i>Table 2A: Individual Level</i>								

Sr. no.	Aspect	Variable	Sr. no.	Measuring Item	Score (Maximum)	SP (POS-1)	DP (POS-2)	LMP (POS-3)
<b>Community level</b>								
3	Social	Diversity in use	11	Presence of people of diverse age, class, gender, and religion	5	2.92	3.95	3.14
		Engagement	12	Space promotes social, necessary and optional activities	5	3.46	2.17	2.38
		Events	13	Space provides opportunity to conduct/ participate activities and events	5	2.87	1.55	2.77
		Use	14	Space flexibility to adapt changes as per need of users	5	2.10	1.84	2.82
		Soft and lively edges	15	Space has soft and lively edges that include facilities like seating, eating, reading and soft drinks	5	2.00	1.26	2.42
4	Economic	livelihood	16	Space enhance surrounding / local businesses such as shopping, hotels, and street food	5	3.54	2.46	2.15
		Quality of life	17	Space enhances quality of life of local sellers, business persons and service providers and acts a source of income	5	2.84	2.73	2.52
		Stimulate	18	Space increases adjoining properties prices	5	3.70	1.35	1.72
		Revenue	19	Space contributes to city tourism and generates economy	5	2.05	1.40	1.35
		Health	20	Space responsible to reduce the expenditure on health	5	3.59	2.85	3.18
				<b>(Community level) Total score</b>	<b>50</b>	<b>29.08</b>	<b>21.57</b>	<b>24.46</b>
<b>Table 2: Result of Space Responsive Index (SRI) for three POSs</b> <b>Table 2B: Community Level</b>								

Sr. no.	Aspect	Variable	Sr. no.	Measuring Item	Score (Maximum)	SP (POS-1)	DP (POS-2)	LMP (POS-2)
<b>Environment level</b>								
5	Built environment	Linkages	21	Space well connected to surrounding areas through roads and footpaths	5	3.78	1.51	3.18
		Convenience	22	Space well connected with convenient and eco-friendly public transportation	5	3.24	1.32	2.70
		Happiness and satisfaction	24	Neighbourhood residences are happy and satisfy with services offered by the space	5	3.80	1.39	3.16
		Enhance living standard	23	Space contributes to higher standard of living and quality of life to neighbourhood residences	5	3.59	2.76	3.68
		Pleasure	25	Occupants feel proud for having such POS in their neighbourhood	5	2.77	1.94	2.63
6	Natural environment	Clean environment	26	Space responsible for reduce heat island effect, traffic noise and improves air quality	5	2.95	2.13	2.99
		Reduction in natural source and maintenance	27	Space promotes sustainable landscape through native species and xeriscaping	5	1.98	1.41	1.49
		Connect to nature	28	User enjoy natural environment provided by the space	5	3.49	1.73	2.28
		Sustainability	29	Space promotes sustainability through use of solar energy, waste water for landscape, bio toilets, energy saving electric equipments	5	1.86	1.80	1.35
		Biodiversity	30	Space is residence of many flora and fauna	5	3.97	2.92	2.71
				<b>(Environment level) Total score</b>	<b>50</b>	<b>31.43</b>	<b>18.93</b>	<b>26.18</b>
				<b>Overall score</b>	<b>150</b>	<b>87.22</b>	<b>64.50</b>	<b>78.01</b>
				<b>Overall score (In percentage)</b>	<b>100</b>	<b>58.15</b>	<b>43.00</b>	<b>52.01</b>
Source for all tables: SPSS 25								
<b>Table 2: Result of Space Responsive Index (SRI) for three POSs</b>								
<b>Table 2C: Environmental Level</b>								

### Reliability analysis and the correlation of measuring items

The study considers the latent variable, 'perception' for measuring the space responsiveness. The aspects and measuring items included in the index are directly and indirectly associated with it. Therefore, Cronbach's alpha is carried out to assure the internal consistency of measuring items. Cronbach's alpha also aids in determining whether the scale developed for the study is serving its intent (De Vaus, 2002). The efficiency of Cronbach's alpha having .70 or more considered as 'acceptable' (Cortina, 1993; Ryan, 2005). **Table 3** shows the reliability analysis of measuring items for three POSs. Furthermore, Pearson bivariate correlation analysis was employed to find the correlation two variables. In this study, the characteristics of the POS and the services they provide were considered independent variables, while user perception was considered a dependent variable. **Table 4** shows the study's identified correlations. These correlations are discussed in the discussion section.

Table 3 : Reliability Analysis				
Sr.No	Measuring Items	Cronbach's Alpha ( $\alpha$ )		
		SP (POS-1) (n=105)	DP (POS-2) (n=127)	LMP (POS-3) (n=79)
1	30	.747	.727	.742
Source: SPSS 25				

Table 4 : Correlation between space characters and users' perception/ use								
S r n o	Space characters (Independent variable)	Users' perception/use (Dependent variable)	SP (POS-1)		DP (POS-2)		LMP (POS-3)	
			Pearson correlation	Sig.	Pearson correlation	Sig.	Pearson correlation	Sig.
1	Space includes memorable architecture, public art and landscape features	Perceived image (legibility) of space that easy to recognise	.201*	0	–	–	.294**	0
2	Space promotes active and passive recreational activities	Presence of people of diverse age, class, gender, and religion	.316**	0	.356**	0	–	–



3	Space includes comfortable furniture, signage, sculptures and details concerning to human scale	Space offers ease to users that give them relief and peace of mind	.225 <sup>*</sup>	0.021	.231 <sup>**</sup>	0.009	-	-
4	Variety of landscape elements within the space that providing sensory complexity	Perceived image (legibility) of space that easy to recognise	-	-	-	-	.238 <sup>**</sup>	0
5	Natural environment provided by the space	Space offers ease to users that give them relief and peace of mind	.525 <sup>**</sup>	0	.302 <sup>*</sup>	0	.133 <sup>**</sup>	0.00
6	Space has soft and lively edges that include facilities like seating, eating, reading and soft drinks	Space contributes to city tourism and generates economy	.127 <sup>*</sup>	0.039	-	-	-	-
7	Space provides opportunity to conduct/ participate activities and events	Space contributes to higher standard of living and quality of life to neighbourhood residences	-	-	.343 <sup>**</sup>	0	-	-
8	Space promotes active and passive recreational activities	Neighbourhood residences are happy and satisfy with services offered by the space	.513 <sup>**</sup>	0	.186 <sup>**</sup>	0.003	-	-
9	Space provides opportunity to conduct/ participate activities and events	Occupants feel proud for having such POS in their neighbourhood	-	-	-	-	.432 <sup>**</sup>	0
10	Space is residence of many flora and fauna	User enjoy natural environment provided by the space	.428 <sup>**</sup>	0	.286 <sup>**</sup>	0.007	-	-
**. Correlation is significant at the 0.01 level (2-tailed).								
*. Correlation is significant at the 0.05 level (2-tailed).								
Source: SPSS 25								

## Discussion

The results of the study indicated the POSSs' strengths and deficiencies. First, when it came to describing the physical aspect at the 'individual-level,' SP and LMP received high score from users. Users claimed that these POSSs provide easy physical access to them. The location of POSSs in their neighbourhoods is easily identified and approachable from all directions. Furthermore, the highlighted and decorated entrance gates of these spaces give users a positive and welcoming feeling. Studies conducted Whyte, (1980) supports such findings. According to observations, paved and uniformly surfaced pathways encourage walking and jogging. The study discovered a positive correlation indicating that comfortable furniture, signage, and sculptures at human scale provide users with relief ( $r = .225^*$ ,  $p \leq 0.05$  and  $.231^{**}$ ,  $p \leq 0.01$ ). A positive correlation occurs when the value of both the independent and dependent variables rises or falls at the same time. Convenient seating encourages social interaction and improves space usability. This seating arrangement was preferred by users for chit-chat and discussion, particularly by senior citizens and women. It also lengthens their stay within the spaces. Carr et al. (1992) and Gehl (2013) conducted studies that support these statements. Another correlation discovered is that memorable architecture, public art, and landscape features assist users in recognising the space and creating a POSitive image in their minds ( $r = .201^*$ ,  $p \leq 0.05$  and  $.294^{**}$ ,  $p \leq 0.01$ ). Signage, sculpture, and other details provided in SP and LMP improve users' perception and aid in their understanding of the spaces. The findings also revealed that the POS environment plays a significant role in providing users with relief and peace of mind ( $r = .302^*$ ,  $p \leq 0.05$  and  $.133^{**}$ ,  $p \leq 0.01$ ).

All spaces encourage both active and passive activities. It has been observed that young people prefer to engage in active activities, whereas senior citizens prefer passive activities to spend their time in POSSs. The study identified a correlation that if a space promotes both active and passive recreational activities, people of all ages, classes, and genders prefer to visit that space ( $r = .316^{**}$  and  $.356^{**}$ ,  $p \leq 0.01$ ). Based on the findings, *it is recommended that when designing POSSs, planners and designers think critically about location, access, and pathways of POSSs. The physical and psychological well-being of users should be prioritised. Additionally, high-quality, visually appealing furniture, landscaping, signs, statuary, fountains, lighting, and other details should be included in POSSs. These elements enhance the space's aesthetics, make it perceptible, and provide users with visual comfort. It is also essential to provide a variety of activities within POSSs in order to attract users and encourage them to spend as much time as POSSible in the space.* The study also highlighted deficiency of the spaces in this category. The pathways in all POSSs lack tactile flooring, which could assist visually impaired users in walking. Spaces do not support 'universal design.' The 'safety' variable was rated poorly by users across all spaces. They requested that security guards, lights, and CCTV cameras be added to the security arrangements. Broken benches and a lack of signage in DP reduced its responsiveness score. Users argue that these features play an important role in forming the space identity, strengthening the space-human bond, and creating a sense of attachment. *As a result, it is recommended that planners and designers emphasise factors such as universal design and safety when designing POSSs.*

The 'community level' result demonstrates that all POSs promote a social aspect. People are encouraged to enter and use POSs regardless of their age, gender, socioeconomic background, or religion. In this way, POSs promote inclusiveness, which was identified as strength in the study. SP and LMP promote social, necessary, and optional activities, as well as increased user engagement with POSs. SP and LMP users appreciated that the spaces host a variety of cultural programmes and events. According to the study's findings, if a space provides opportunities for users and adjacent neighbourhood occupants to participate in cultural programmes and activities, it contributes to a higher standard of living and quality of life ( $r=.343^{**}$ ,  $p\leq 0.01$ ). They are pleased to have such a space in their neighbourhood ( $r=.432^{**}$ ,  $p\leq 0.01$ ). Furthermore, users and neighbourhood occupants are satisfied with the space ( $r= 513^{**}$  and  $186^{**}$ ,  $p\leq 0.01$ ).

Other findings concerning the social aspect revealed that, senior citizens prefer to interact with people their own age, status, and gender. They also prefer to spend their time in areas of silence within the POS. Mid-aged women, on the other hand, preferred to sit near children's play areas where they could socialise with others while keeping an eye on their children. Mid-aged people engaged in a variety of activities. Young people visited the space in groups and engaged in lively and spontaneous discussions. They also enjoyed photographing that recreational event. Askari and Soltani's (2019) research supports these statements. *Based on the findings, it was suggested that planners and designers incorporate a variety of activities in POSs that can engage people of all ages. POSs should promote inclusiveness and give users the opportunity to participate in social and cultural programmes. To make spaces livelier, facilities such as shopping, food, and soft drink stalls should be available at the edges. These characteristics of POSs not only help to improve social contacts, relationships, and attachment, but they also help to develop a socially healthy society within cities.*

The results of the economic aspect showed that POSs enhance business of hotels, street vendors, and other shops and thus provide people with livelihood opportunities. SP and LMP users claimed that their health expenditure has been reduced as a result of POS facilities such as yoga, meditation, open gym, walking, and jogging. However, these facilities were not present in the DP. This deficiency lowered DP's score and had an impact on its responsiveness. *As a result, such facilities are recommended in POSs.*

The results showed that SP and LMP received high scores in the Environmental aspect because they have good connectivity with adjoining neighbourhoods as well as other areas of the city. Proper road and footpath networks, and the availability of convenient and environmentally friendly public transportation, encourage city dwellers to visit the spaces. Such a feature was appreciated by users. The next aspect, natural environment assesses the capacity of space to support nature. Neighbourhood occupants and users argue that POSs help to reduce the heat island effect, which is especially noticeable during the summer, when Nagpur's temperature can reach 46-48 degrees celsius. According to the study's findings, people enjoy visiting POSs with flora and fauna and a pleasing natural environment on a regular basis ( $r=.428^{**}$  and  $.286^{**}$ ,  $p\leq 0.01$ ). *Based on the findings, it is recommended that linkages such as roads, footpaths, and public transportation play an important role in increasing the use and responsiveness of POSs. To make it easier for*

*people, planners and designers should properly connect the POSs to other areas of the city. Furthermore, POSs should promote flora and fauna and have a pleasing environment that connects users to nature.* In contrast, deficiency indicates that All POSs have failed to implement sustainable landscape practices such as the use of native species, the preservation of natural topography, xeriscaping, rainwater harvesting, water-efficient irrigation systems, and intelligent artificial lighting. POSs received a low score in the variable. *This study recommends using sustainable practices when designing POSs. They are a twenty-first-century requirement for natural resource conservation.*

The study includes some additional recommendations for POS evaluation, design standards, and policy framework. These recommendations would aid the parental authority as well as government agencies in developing policies to create inclusive and sophisticated POSs throughout the city.

1. It is critical to design a policy that promotes green or eco-friendly public transit and promotes the construction of a safe, convenient, and barrier-free pedestrian walkways in the city. It must be created.
2. Existing POSs should be evaluated on a local community level with inhabitants to see if they satisfy their needs. The evaluation will also help determine what people expect from POSs.
3. The authority must devise a strategy for increasing current POSs in densely populated areas. National or international norms and standards must be followed when establishing POSs in newly developing areas. When calculating the space-capita ratio, future population projections should be taken into account.
4. Experts such as urban designers, planners, sociologists, climatologists, horticulture experts, landscape architects, and institutions must work together to establish a POS design standard at the state and national levels.
5. Policies should be developed to support POS planning and design while also promoting inclusiveness. These policies should be appropriate to the needs of city dwellers and aid in the advancement of modern lifestyles and well-being.
6. A smooth and convenient strategy for applying the policies is also required.

## Conclusions

This study contributes to the expanding body of knowledge by investigating the significance of POSs to city dwellers. It focuses on space responsiveness, a comprehensive approach that improves city quality of life and fosters man-nature relationship. The study also promotes the social, economic, and environmental dimensions of POSs by including them in the index formulation. It provides a forum for city dwellers to share their perceptual experiences and ideas for improving the quality of POSs. The study encourages public participation in the planning of POSs. It also suggests that POSs be

designed in such a way that they promote responsiveness at the individual, community, and environmental levels in order to achieve long-term results. The study is being conducted in the developing country of India, where qualitative POSs are in high demand by a large city population. It also draws the attention of the parental authority, government agencies and recommends them to use this approach to create livable, attractive, and functional spaces.

The study's recommendations have a practical application. It emerges modern and pragmatic ideas for planning POSs in a developing country. It suggests that proper initiatives will improve POSs' qualitative character and make them capable of serving various facilities at their best. The study findings can be used by parental authority to design new POSs or to upgrade existing ones. They should adopt new thoughts and ideas while making design decisions. Other local or international researchers could use the SRI to evaluate POSs in their cities. The SRI's variables and measuring items are adaptable and can change based on the needs and priorities of local users. The study has some limitations. To measure the space responsiveness, it used only active parks as POSs. Citizens typically visit these parks at specific times of day. Plazas, playgrounds, and waterfront spaces are examples of POSs that also contribute to daily well-being. These spaces must also be evaluated in terms of their responsiveness capabilities. Future research can consider these spaces for the study of the developing country context. ■

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## References

Akalin, A., Yildirim, K., Wilson, C., and Kilicoglu, O. (2009). Architecture and engineering students' evaluations of house façades: Preference, complexity and impressiveness. *Journal of environmental psychology*, 29(1), 124-132.

Ahirrao, P., and Khan, S. (2022). Evaluating public open spaces through the lively planning integrative perspective: a developing country context. *Environment, Development and Sustainability*, 24(4), 5225-5257. <https://doi.org/10.1007/s10668-021-01656-x>

Aram, F., Solgi, E., and Holden, G. (2019). The role of green spaces in increasing social interactions in neighbourhoods with periodic markets. *Habitat International*, 84, 24-32.

Askari, A. H., and Soltani, S. (2019). Determinants of a successful public open space: the case of Dataran Merdeka in the city centre of Kuala Lumpur, Malaysia. *Landscape Research*, 44(2), 162-173.

- Ayala-Azcárraga, C., Diaz, D., and Zambrano, L. (2019). Characteristics of urban parks and their relation to user well-being. *Landscape and Urban Planning*, 189, 27-35.
- Banerjee, T. (2001). The future of public space: beyond invented streets and reinvented places. *Journal of the American planning association*, 67(1), 9-24.
- Basu, S., & Nagendra, H. (2021). Perceptions of park visitors on access to urban parks and benefits of green spaces. *Urban Forestry & Urban Greening*, 57, 126959.
- Barker, A., Crawford, A., Booth, N., and Churchill, D. (2019). Park futures: Excavating images of tomorrow's urban green spaces. *Urban Studies*, 0042098019875405.
- Bentley, I., Alcock, A., and Murrain, P. McGlynn, S and Smith, G. 1985. Responsive Environments—A manual for designers.
- Carmona, M. (2019). Principles for public space design, planning to do better. *Urban Design International*, 24(1), 47-59.
- Carmona, M., Heath, T., Tiesdell, S., and Oc, T. (2010). *Public places, urban spaces: the dimensions of urban design*. Routledge.
- Carr, S., Francis, M., Rivlin, L. G., and Stone, A. M., 1992, *Public Space*. Cambridge, UK: Cambridge University Press.
- Chiesura, A. (2004). The role of urban parks for the sustainable city. *Landscape and urban planning*, 68(1), 129-138. <https://doi.org/10.1016/j.landurbplan.2003.08.003>
- Charkhchian, M., and Daneshpour, S. A. (2009, March). Interactions among different dimensions of a responsive public space: Case study in Iran. In *Review of Urban and Regional Development Studies: Journal of the Applied Regional Science Conference* (Vol. 21, No. 1, pp. 14-36). Melbourne, Australia: Blackwell Publishing Asia.
- Chaudhry, P., Bagra, K., and Singh, B. (2011). Urban greenery status of some Indian cities: A short communication. *International Journal of Environmental Science and Development*, 2(2), 98.
- Cilliers, E. J., Timmermans, W., Van den Goorbergh, F., and Slijkhuis, J. S. A. (2015). Designing public spaces through the lively planning integrative perspective. *Environment, development and sustainability*, 17(6), 1367-1380.
- Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of applied psychology*, 78(1), 98.
- De Vaus, D. (2002). *Surveys in Social Research*, Routledge.
- Field, D. R., and Wagar, J. A. (1973). Visitor groups and interpretation in parks and other outdoor leisure settings. *The Journal of Environmental Education*, 5(1), 12-17.
- Fink, A. (2003). *The survey handbook*. Sage.

Gaikwad, A., and Shinde, K. (2019). Use of parks by older persons and perceived health benefits: A developing country context. *Cities*, 84, 134-142.

Gehl, J. (2011). *Life between buildings: using public space*. Island Press.

Gehl, J. (2013). *Cities for people*. Island Press.

Glover, T. (2017). Leisure, social space, and belonging. In *The Palgrave handbook of leisure theory* (pp. 873-890). Palgrave Macmillan, London.

Grilli, G., Mohan, G., and Curtis, J. (2020). Public park attributes, park visits, and associated health status. *Landscape and Urban Planning*, 199, 103814.

Jacobs, J., 1961, *The Death and Life of Great American Cities*. New York, NY: Random House.

Kim, J. (2019). Eating outdoors: an inscription–prescription analysis of user behaviour in public spaces. *URBAN DESIGN International*, 24(4), 280-295.

Li, C. L. (2020). Quality of life: The perspective of urban park recreation in three Asian cities. *Journal of Outdoor Recreation and Tourism*, 29, 100260.

Low, S., and Smith, N. (Eds.). (2013). *The politics of public space*. Routledge.

Lynch, K., Lynch, K. R., and Hack, G. (1984). *Site planning*. MIT press.

Madanipour, A. (Ed.). (2013). *Whose public space?: International case studies in urban design and development*. Routledge.

Mahadevia, D., and Lathia, S. (2019). Women's safety and public spaces: Lessons from the Sabarmati riverfront, India. *Urban Planning*, 4(2), 154-168.

Mcglynn, S., Smith, G., Alcock, A., and Murrain, P. (2013). *Responsive environments*. Routledge.

Mehta, V. (2014). Measuring public space. *Journal of Urban Design*, 19(1), 53-88.

MoUD, 2014( Ministry of Housing and Urban Development, Government of India)  
<http://mohua.gov.in/minister/Rao-Inderjit-Singh.php>

Mumford, L. (2016). *The culture of cities* (Vol. 19). Open Road Media.

Nasution, A. D., & Zahrah, W. (2014). Community perception on public open space and quality of life in Medan, Indonesia. *Procedia-Social and Behavioral Sciences*, 153, 585-594.  
<https://doi.org/10.1016/j.sbspro.2014.10.091>

Parra, D. C., Gomez, L. F., Fleischer, N. L., & Pinzon, J. D. (2010). Built environment characteristics and perceived active park use among older adults: Results from a multilevel study in Bogota. *Health & Place*, 16(6), 1174-1181.

Perera, L. A. S. R. (2001). Social dimensions of the built environment; some conceptual insights. *The Sri Lanka Architect*, 101(02), 13-20.

PPS.(2019), "What makes a successful space?" <https://www.pps.org/article/grplacefeat>

Romolini, M., Ryan, R. L., Simso, E. R., and Strauss, E. G. (2019). Visitors' attachment to urban parks in Los Angeles, CA. *Urban Forestry and Urban Greening*, 41, 118-126.

Ryan, R. L. (2005). Exploring the effects of environmental experience on attachment to urban natural areas. *Environment and behavior*, 37(1), 3-42.

Sakip, S. R. M., Akhir, N. M., and Omar, S. S. (2015). Determinant factors of successful public parks in Malaysia. *Procedia-Social and Behavioral Sciences*, 170, 422-432.

Singh, V. S., Pandey, D. N., and Chaudhry, P. (2010). *Urban forests and open green spaces: lessons for Jaipur, Rajasthan India* (pp. 1-18). Jaipur: Rajasthan State Pollution Control Board.

Sreetheran, M. (2017). Exploring the urban park use, preference and behaviours among the residents of Kuala Lumpur, Malaysia. *Urban Forestry and Urban Greening*, 25, 85-93.

Subramanian, D., and Jana, A. (2018). Assessing urban recreational open spaces for the elderly: A case of three Indian cities. *Urban forestry and urban greening*, 35, 115-128.

Thomas, R. M. (2003). *Blending qualitative and quantitative research methods in theses and dissertations*. Corwin Press.

Ujang, N., Kozłowski, M., and Maulan, S. (2018). Linking place attachment and social interaction: towards meaningful public places. *Journal of Place Management and Development*.

Uma, V. R. (2018). Environmental Challenges in Urban India-An Analysis. *International Journal in Management and Social Science*, 6(2), 9-22.

UN Habitat III, Agenda, <http://habitat3.org/the-conference/about-habitat-3/>

Whyte, W. H., 1980, *The Social Life of Small Urban Spaces*. Washington, DC: The Conservation Foundation.

Woolley, H. (2003). *Urban open spaces*. Taylor and Francis.

Zamanifard, H., Alizadeh, T., Bosman, C., and Coiacetto, E. (2019). Measuring experiential qualities of urban public spaces: users' perspective. *Journal of Urban Design*, 24(3), 340-364.